2015 FIFRA SECTION 18

General information requirements of §40 CFR 166.20(a) in an application for a specific exemption.

TYPE OF EXEMPTION BEING REQUESTED

✓ SPECIFIC

QUARANTINE

PUBLIC HEALTH

SECTION 166.20(a)(1): IDENTITY OF CONTACT PERSONS

i. This application to the Administrator of the Environmental Protection Agency (EPA) for a specific exemption to authorize the use of Sulfoxaflor (Transform® WG Insecticide EPA Reg. No. 62719-625) to control the newly introduced sugarcane aphid, *Melanaphis sacchari* in sorghum by the Texas Department of Agriculture. Any questions related to this request should be addressed to:

Dale R. Scott
Coordinator for Pesticide Product Evaluation and Registration
Texas Department of Agriculture
P.O. Box 12847
Austin, TX 78711
Phone: (512) 936-2535
Fax: (888) 216-9860
dale.scott@TexasAgriculture.gov

ii. The following qualified experts are also available to answer questions:

University Representatives:
Dr. M.O. (Mo) Way
Professor of Entomology
Texas A&M AgriLife Research and Extension Center
1509 Aggie Drive
Beaumont, TX 77713
409.752.2741 x 2231 (office)
moway@aesrg.tamu.edu

Raul T. Villanueva - Ph. D.
Texas A&M AgriLife Extension
Assistant Professor and Entomologist
2401 East Highway 83, Weslaco, TX 78596
rtvillanueva@ag.tamu.edu
Tel: (956) 968-5581
Tel: (956) 969-5604
Fax: (956) 969-5639

Registrant Representative:
Tami Jones-Jefferson
U.S. Regulatory Leader
U.S. Regulatory & Government Affairs - Crop Protection
Dow AgroSciences
9330 Zionsville Road
Indianapolis IN 46268
phone: 317.337.3574
email: tjjonesjefferson@dow.com

SECTION 166.20(a)(2): DESCRIPTION OF THE PESTICIDE REQUESTED

i. **Common Chemical Name (Active Ingredient):** Sulfoxaflor

Trade Name and EPA Reg. No.: Transform® WG Insecticide, EPA Reg. No. 62719-625

Formulation: Active Ingredient 50%

SECTION 166.20(a)(3): DESCRIPTION OF THE PROPOSED USE

i. Sites to be treated:
Sorghum fields (grain and forage) with the sugarcane aphid, *Melanaphis sacchari* statewide.

ii. Method of Application:
Applications will be made by foliar application.

iii. Rate of Application:
0.75 – 1.5 oz of Transform® WG/acre (0.023 – 0.047 lb ai/acre)

iv. **Maximum Number of Applications:**
2 applications per year (maximum of 3 oz/acre (0.094 lb ai/acre)

v. Total Acreage to be Treated:

According to the National Agricultural Statistics Service (NASS), 3 million acres of sorghum was planted in Texas in 2013.

vi. Total Amount of Pesticide to be used:

According to the previously mentioned statistics, if all 3 million acres of sorghum were treated with the maximum rate (1.5 oz/acre or 0.047 lb ai/acre) and the maximum numbers of applications are made (2 applications or 3.0 oz/acre or 0.094 lb ai/acre) then 70,313.5 gallons of Transform® WG would be used in 2015.

vii. Restrictions and Requirements:

- Preharvest Interval: Do not apply within 7 days of harvest for grain or 14 days of harvest for forage, hay or stover.
- Minimum Treatment Interval: Do not make applications less than 14 days apart.
- Do not make more than two applications per acre per year.
- Do not apply more than a total of 3.0 oz of Transform WG (0.09 lb ai of sulfoxaflor) per acre per year.

Duration of the Proposed use:

Early Spring through Late Fall

viii. Earliest Possible Harvest Date:

Late May in South Texas

SECTION 166.20(a)(4): ALTERNATIVE METHODS OF CONTROL

Registered Alternative Pesticides:

Of the registered alternative pesticides, only Dimethoate 4 EC (dimethoate, EPA Reg. No. 19713-231) has provided adequate control. Dimethoate is an organophosphate which is labeled for use on sorghum at 1 pint per acre. Dimethoate, which is highly toxic to bees, has a use restriction that does not allow its use during pollen shed in sorghum. Insects have historically shown resistance to organophosphates. Three other pesticides registered for use in sorghum did not provide adequate control of the aphid. Those pesticides are:

Karate® with Zeon™ Technology (Lambda Cyholothrin 22.8%, EPA Reg. No. 100-1097)
Lorsban® Advanced, others (Chlorpyrifos 40.2%, EPA Reg. No. 62719-591)
Asana® XL (Esfenvalerate 8.4%, EPA Reg. No. 352-515)

Of the above mentioned insecticides, Karate® and Asana® are pyrethroids and Lorsban® is an organophosphate. Both pyrethroids and organophosphates have shown resistance potential. In field tests conducted in 2013 by Texas A&M AgriLife professionals, Karate® and Asana® both provided some initial population reduction when used at labeled rates. However, population spikes were observed soon after treatments in some instances. Chlorpyrifos did not provide satisfactory control at labeled rates.

For the 2015 growing season, Sivanto® (PRIA date scheduled for November 2014) will likely be available to producers for SCA control. However, this product may prove to be too expensive for such a low input crop and may not be economically feasible for most producers. In any event, Transform® is still needed to prevent resistance build up, which is common in aphids.

A few varieties of resistant sorghum have been identified by researchers, but sufficient quantities of agronomically acceptable cultivars will not be available for the 2015 planting season.

Table to Address Issues with Registered Alternatives:

Chemical (active ingredient)	**Application Type (soil, seed, foliar, etc.)**	**Number of Applications/ growing season**	**Comments- reason insecticide unsuitable**
Imidacloprid	Seed	1	Due to the nature of the application as a seed treatment, it is doubtful that it can provide season-long control. Further tests will be evaluated this season.
Clothianidin	Seed	1	Due to the nature of the application as a seed treatment, it is doubtful that it can provide season-long control. Further tests will be evaluated this season.
Thiamethoxam	Seed	1	Due to the nature of the application as a seed treatment, it is doubtful that it can provide season-long control. Further tests will be evaluated this season.
Dimethoate	Foliar	3	Provided inconsistent control. Has restriction of no applications during pollen shed due to the toxicity to bees. 28 day PHI
Chlorpyrifos	Foliar	3	Results of less than satisfactory control. PHI prevents late season application. (30 days PHI of 1 pint/acre, 60 days PHI of 1+ pints/acre)
Lambda Cyhalothrin	Foliar	3 (can only apply twice after crop has emerged and once after is in soft dough stage.	Good initial control, but flared populations in test. 30 day PHI.

Esfenvalerate	Foliar	1	Good initial control, but residual was short, actually flaring populations. 21 day PHI
Turbufos	Soil - Band @ planting	1 - 5cm wide band	Will not provide season long control.

SECTION 166.20(a)(5): EFFICACY OF USE PROPOSED UNDER SECTION 18

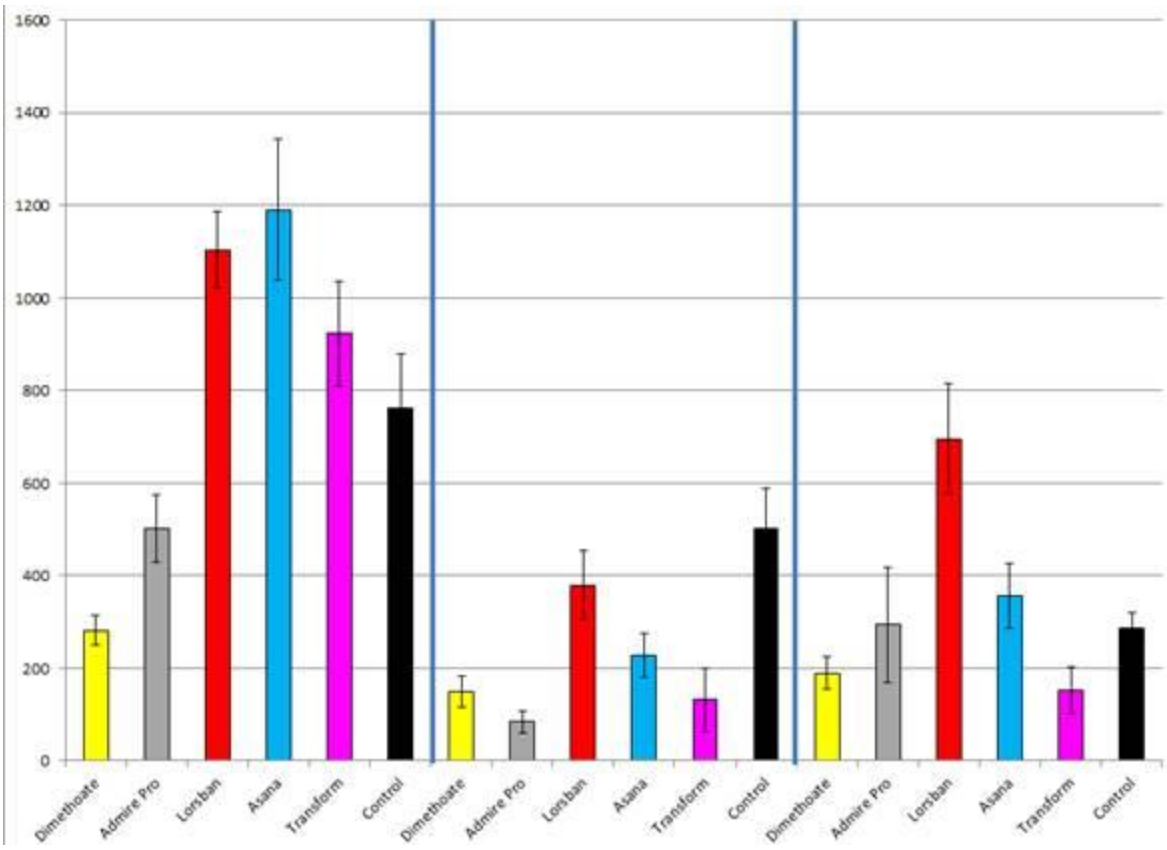
Two replicated field trials were conducted on the aphid in 2013. The first was conducted by Dr. Mo Way in August in China, Texas. The second replicated test was conducted in Weslaco, Texas, by Dr. Raul Villanueva and D. Sekula. In both trials, data showed that Transform® WG at 0.75/acre provided good control of *Melanaphis sacchari.*

Several tests were conducted during the 2014 growing season. These trials confirmed that sulfoxaflor gave outstanding control when compared to other registered products in controlling *Melanaphis sacchari* in sorghum production. The applications allowed under the section 18 exemption also showed overwhelming success of the insecticide in Texas.

The following documents provide data to support the efficacy of sulfoxaflor for control of *Melanaphis sacchari* in sorghum:

2014 Grain Sorghum Insecticide Efficacy Trials (Attachment A)
Sorghum Insecticide Screening for 2014 Annual Report (Attachment B)
Dr. Way ALL DATA for Sorghum Insecticide Screening (Attachment C)
Brewer Data (Attachment D)
An Integrated Regional Response to an Invasive Aphid Pest of Sorghum (Attachment E)

Based on the 2013 Weslaco data it seemed that dimethoate worked as well as Transform, (see graph bellow for precounting, 7dd and 14daa) however Dr. Kerns and Mexican colleagues did not have good results. In addition the PHI of Dimethoate is 38 days. In the Lorsban and Asana plots you can see increase of populations at 14 daa. The time was flowering to grain filling. By the way grains did not fill and they looked wrinkled and dehydrated.



Pre-Count 7dd 14dd

SECTION 166.20(a)(6): EXPECTED RESIDUES FOR FOOD USES

Michael Hare, Ph.D.

Acute Assessment

Food consumption information from the USDA 1994-1996 and 1998 Nationwide Continuing Surveys of Food Intake by Individuals (CSFII) and maximum residues from field trials rather than tolerance-level residue estimates were used. It was assumed that 100% of crops covered by the registration request are treated and maximum residue levels from field trials were used.

Drinking water. Two scenarios were modeled, use of sulfoxaflor on non-aquatic row and orchard crops and use of sulfoxaflor on watercress. For the non-aquatic crop scenario, based on the Pesticide Root Zone Model/Exposure Analysis Modeling System (PRZM/EXAMS) and Screening Concentration in Ground Water (SCI-GROW) models, the estimated drinking water concentrations (EDWCs) of sulfoxaflor for acute exposures are 26.4 ppb for surface water and 69.2 ppb for ground water. For chronic exposures, EDWCs are 13.5 ppb for surface water and 69.2 ppb for ground water. For chronic exposures for cancer assessments, EDWCs are 9.3 ppb for surface water and 69.2 ppb for ground water. For the watercress scenario, the EDWCs for

surface water are 91.3 ppb after one application, 182.5 ppb after two applications and 273.8 ppb after three applications.

Dietary risk estimates using both sets of EDWCs are below levels of concern. The non-aquatic-crop EDWCs are more representative of the expected exposure profile for the majority of the population. Also, water concentration values are adjusted to take into account the source of the water; the relative amounts of parent sulfoxaflor, X11719474, and X11519540; and the relative liver toxicity of the metabolites as compared to the parent compound.

For acute dietary risk assessment of the general population, the groundwater EDWC is greater than the surface water EDWC and was used in the assessment. The residue profile in groundwater is 60.9 ppb X11719474 and 8.3 ppb X11519540 (totaling 69.2 ppb). Parent sulfoxaflor does not occur in groundwater. The regulatory toxicological endpoint is based on neurotoxicity.

For acute dietary risk assessment of females 13-49, the regulatory endpoint is attributable only to the parent compound; therefore, the surface water EDWC of 9.4 ppb was used for this assessment.

A tolerance of 0.3 ppm for sulfoxaflor on grain sorghum has been established. There is no expectation of residues of sulfoxaflor and its metabolites in animal commodities as a result of the proposed use on sorghum. Thus, animal feeding studies are not needed, and tolerances need not be established for meat, milk, poultry, and eggs.

Drinking water exposures are the driver in the dietary assessment accounting for 100% of the exposures. Exposures through food (sorghum grain and syrup) are zero.

The acute dietary exposure from food and water to sulfoxaflor is 16% of the aPAD for children 1-2 years old and females 13-49 years old, the population groups receiving the greatest exposure.

Chronic Assessment

The same refinements as those used for the acute exposure assessment were used, with two exceptions: (1) average residue levels from crop field trials were used rather than maximum values and (2) average residues from feeding studies, rather than maximum values, were used to derive residue estimates for livestock commodities. It was assumed that 100% of crops are treated and average residue levels from field trials were used.

For chronic dietary risk assessment, the toxicological endpoint is liver effects, for which it is possible to account for the relative toxicities of X11719474 and X11519540 as compared to sulfoxaflor. The groundwater EDWC is greater than the surface water EDWC. The residue profile in groundwater is 60.9 ppb X11719474 and 8.3 ppb X11519540. Adjusting for the relative toxicity results in 18.3 ppb equivalents of X11719474 and 83 ppb X11519540 (totaling 101.3 ppb). The adjusted groundwater EDWC is greater than the surface water EDWC (9.3 ppb) and was used to assess the chronic dietary exposure scenario.

The maximum dietary residue intake via consumption of sorghum commodities would be only a small portion of the RfD (<0.001%) and therefore, should not cause any additional risk to humans via chronic dietary exposure. Consumption of sorghum by sensitive sub-populations such as children and non-nursing infants is essentially zero. Thus, the risk of these subpopulations to chronic dietary exposure to sulfoxaflor used on grain sorghum would be insignificant.

The major contributor to the risk was water (100%). There was no contribution from grain sorghum to the dietary exposure. All other populations under the chronic assessment show risk estimates that are below levels of concern.

Chronic exposure to sulfoxaflor from food and water is 18% of the cPAD for infants, the population group receiving the greatest exposure. There are no residential uses for sulfoxaflor.

Short-term risk. Because there is no short-term residential exposure and chronic dietary exposure has already been assessed, no further assessment of short-term risk is necessary, the chronic dietary risk assessment for evaluating short-term risk for sulfoxaflor is sufficient.

Intermediate-term risk. Intermediate-term risk is assessed based on intermediate-term residential exposure plus chronic dietary exposure. Because there is no residential exposure and chronic dietary exposure has already been assessed, no further assessment of intermediate-term risk is necessary.

Cumulative effects. Sulfoxaflor does not share a common mechanism of toxicity with any other substances, and does not produce a toxic metabolite produced by other substances. Thus, sulfoxaflor does not have a common mechanism of toxicity with other substances.

Cancer. A nonlinear RfD approach is appropriate for assessing cancer risk to sulfoxaflor. This approach will account for all chronic toxicity, including carcinogenicity that could result from exposure to sulfoxaflor. Chronic dietary risk estimates are below levels of concern; therefore, cancer risk is also below levels of concern.

There is a reasonable certainty that no harm will result to the general population, or to infants and children from aggregate exposure to sulfoxaflor as used in this emergency exemption request.

SECTION 166.20(a)(7): DISCUSSION OF RISK INFORMATION

Human Health Effects – Michael Hare, Ph.D.
Ecological Effects – David Villarreal, Ph.D.
Environmental Fate – David Villarreal, Ph.D.

Human Health

Toxicological Profile

Sulfoxaflor is a member of a new class of insecticides, the sulfoximines. It is an activator of the nicotinic acetylcholine receptor (nAChR) in insects and, to a lesser degree, mammals. The nervous system and liver are the target organs, resulting in developmental toxicity and hepatotoxicity.

Developmental toxicity was observed in rats only. Sulfoxaflor produced skeletal abnormalities likely resulting from skeletal muscle contraction due to activation of the skeletal muscle nAChR in utero. Contraction of the diaphragm, also related to skeletal muscle nAChR activation, prevented normal breathing in neonates and increased mortality. The skeletal abnormalities occurred at high doses while decreased neonatal survival occurred at slightly lower levels.

Sulfoxaflor and its major metabolites produced liver weight and enzyme changes, and tumors in subchronic, chronic and short-term studies. Hepatotoxicity occurred at lower doses in long-term studies compared to short-term studies.

Reproductive effects included an increase in Leydig cell tumors which were not treatment related due to the lack of dose response, the lack of statistical significance for the combined tumors, and the high background rates for this tumor type in F344 rats. The primary effects on male reproductive organs are secondary to the loss of normal testicular function due to the size of the Leydig Cell adenomas. The secondary effects to the male reproductive organs are also not treatment related. It appears that rats are uniquely sensitive to these developmental effects and are unlikely to be relevant to humans.

Clinical indications of neurotoxicity were observed at the highest dose tested in the acute neurotoxicity study in rats. Decreased motor activity was also observed in the mid- and high-dose groups. Since the neurotoxicity was observed only at a very high dose and many of the effects are not consistent with the perturbation of the nicotinic receptor system, it is unlikely that these effects are due to activation of the nAChR.

Tumors have been observed in rat and mouse studies. In rats, there were significant increases in hepatocellular adenomas in the high-dose males. In mice, there were significant increases in hepatocellular adenomas and carcinomas in high dose males. In female mice, there was an increase in carcinomas at the high dose. Liver tumors in mice were treatment-related. Leydig cell tumors were also observed in the high-dose group of male rats, but were not related to treatment. There was also a significant increase in preputial gland tumors in male rats in the high-dose group. Given that the liver tumors are produced by a non-linear mechanism, the Leydig cell tumors were not treatment-related, and the preputial gland tumors only occurred at the high dose in one sex of one species, the evidence of carcinogenicity was weak.

Ecological Toxicity

Sulfoxaflor (N-[methyloxido[1-[6-(trifluoromethyl)-3-pyridinyl]ethyl]-lambda 4-sulfanylidene]) is a new variety of insecticide as a member of the sulfoxamine subclass of neonicotinoid insecticides. It is considered an agonist of the nicotinic acetylcholine receptor and exhibits excitatory responses including tremors, followed by paralysis and mortality in target insects. Sulfoxaflor consists of two diastereomers in a ratio of approximately 50:50 with each diastereomer consisting of two enantiomers. Sulfoxaflor is systemically distributed in plants

when applied. The chemical acts through both contact action and ingestion and provides both rapid knockdown (symptoms are typically observed within 1-2 hours of application) and residual control (generally provides from 7 to 21 days of residual control). Incident reports submitted to EPA since approximately 1994 have been tracked via the Incident Data System. Over the 2012 growing season, a Section 18 emergency use was granted for application of sulfoxaflor to cotton in four states (MS, LA, AR, TN). No incident reports have been received in association with the use of sulfoxaflor in this situation.

Sulfoxaflor is classified as practically non-toxic on an acute exposure basis, with 96-h LC_{50} values of >400 mg a.i./L for all three freshwater fish species tested (bluegill, rainbow trout, and common carp). Mortality was 5% or less at the highest test treatments in each of these studies. Treatment-related sublethal effects included discoloration at the highest treatment concentration (100% of fish at 400 mg a.i./L for bluegill) and fish swimming on the bottom (1 fish at 400 mg a.i./L for rainbow trout). No other treatment-related sublethal effects were reported. For an estuarine/marine sheepshead minnow, sulfoxaflor was also practically non-toxic with an LC_{50} of 288 mg a.i./L. Sublethal effects included loss of equilibrium or lying on the bottom of aquaria at 200 and 400 mg a.i./L. The primary degradate of sulfoxaflor is also classified as practically non-toxic to rainbow trout on an acute exposure basis (96-h LC_{50} >500 mg a.i./L).

Adverse effects from chronic exposure to sulfoxaflor were examined with two fish species (fathead minnow and sheepshead minnow) during early life stage toxicity tests. For fathead minnow, the 30-d NOAEC is 5 mg a.i./L based on a 30% reduction in mean fish weight relative to controls at the next highest concentration (LOAEC=10 mg a.i./L). No statistically significant and/or treatment-related effects were reported for hatching success, fry survival and length. For sheepshead minnow, the 30-d NOAEC is 1.3 mg a.i./L based on a statistically significant reduction in mean length (3% relative to controls) at 2.5 mg a.i./L. No statistically significant and/or treatment-related effects were reported for hatching success, fry survival and mean weight.

The acute toxicity of sulfoxaflor was evaluated for one freshwater invertebrate species, the water flea and two saltwater species (mysid shrimp and Eastern oyster). For the water flea, the 48-h EC_{50} is >400 mg a.i./L, the highest concentration tested. For Eastern oyster, new shell growth was significantly reduced at 120 mg a.i./L (75% reduction relative to control). The 96-h EC_{50} for shell growth is 93 mg a.i./L. No mortality occurred at any test concentration. Mysid shrimp are the most acutely sensitive invertebrate species tested with sulfoxaflor based on water column only exposures, with a 96-h LC_{50} of 0.67 mg a.i./L. The primary degradate of sulfoxaflor is also classified as practically non-toxic to the water flea (EC_{50} >240 mg a.i./L).

The chronic effects of sulfoxaflor to the water flea were determined in a semi-static system over a period of 21 days to nominal concentrations of 6.25, 12.5, 25, 50 and 100 mg a.i./L. Adult mortality, reproduction rate (number of young), length of the surviving adults, and days to first brood were used to determine the toxicity endpoints. No treatment-related effects on adult mortality or adult length were observed. The reproduction rate and days to first brood were significantly ($p<0.05$) different in the 100 mg a.i./L test group (40% reduction in mean number of offspring; 35% increase in time to first brood). No significant effects were observed on

survival, growth or reproduction at the lower test concentrations. The 21-day NOAEC and LOAEC were determined to be 50 and 100 mg a.i./L, respectively.

The chronic effects of sulfoxaflor to mysid shrimp were determined in a flow-through system over a period of 28 days to nominal concentrations of 0.063, 0.13, 0.25, 0.50 and 1.0 mg a.i./L. Mortality of parent (F_0) and first generation (F_1), reproduction rate of F_0 (number of young), length of the surviving F_0 and F_1, and days to first brood by F_0 were used to determine the toxicity endpoints. Complete F_0 mortality (100%) was observed at the highest test concentration of 1.0 mg a.i./L within 7 days; no treatment-related effects on F_0/F_1 mortality, F_0 reproduction rate, or F_0/F_1 length were observed at the lower test concentrations. The 28-day NOAEC and LOAEC were determined to be 0.11 mg and 0.25 mg a.i./L, respectively.

Sulfoxaflor exhibited relatively low toxicity to aquatic non-vascular plants. The most sensitive aquatic nonvascular plant is the freshwater diatom with a 96-h EC_{50} of 81.2 mg a.i./L. Similarly, sulfoxaflor was not toxic to the freshwater vascular aquatic plant, *Lemna gibba*, up to the limit amount, as indicated by a 7-d EC_{50} for frond count, dry weight and growth rate of >100 mg a.i./L with no significant adverse effects on these endpoints observed at any treatment concentration.

Based on an acute oral LD_{50} of 676 mg a.i./kg bw for bobwhite quail, sulfoxaflor is considered slightly toxic to birds on an acute oral exposure basis. On a subacute, dietary exposure basis, sulfoxaflor is classified as practically nontoxic to birds, with 5-d LC_{50} values of >5620 mg/kg-diet for mallard ducks and bobwhite quail. The NOAEL from these studies is 5620 mg/kg-diet as no treatment related mortality of sublethal effects were observed at any treatment. Similarly, the primary degradate is classified as practically nontoxic to birds on an acute oral exposure basis with a LD_{50} of >2250 mg a.i./kg bw. In two chronic, avian reproductive toxicity studies, the 20-week NOAELs ranged from 200 mg/kg-diet (mallard, highest concentration tested) to 1000 mg/kg-diet (bobwhite quail, highest concentration tested). No treatment-related adverse effects were observed at any test treatment in these studies.

For bees, sulfoxaflor is classified as very highly toxic with acute oral and contact LD_{50} values of 0.05 and 0.13 µg a.i./bee, respectively, for adult honey bees. For larvae, a 7-d oral LD_{50} of >0.2 µg a.i./bee was determined (45% mortality occurred at the highest treatment of 0.2 µg a.i./bee). The primary metabolite of sulfoxaflor is practically non-toxic to the honey bee. This lack of toxicity is consistent with the cyano-substituted neonicotinoids where similar cleavage of the cyanide group appears to eliminate their insecticidal activity. The acute oral toxicity of sulfoxaflor to adult bumble bees (*Bombus terrestris*) is similar to the honey bee; whereas its acute contact toxicity is about 20X less toxic for the bumble bee. Sulfoxaflor did not demonstrate substantial residual toxicity to honey bees exposed via treated and aged alfalfa (i.e., mortality was <15% at maximum application rates).

At the application rates used (3-67% of US maximum), the direct effects of sulfoxaflor on adult forager bee mortality, flight activity and the occurrence of behavioral abnormalities is relatively short-lived, lasting 3 days or less. Direct effects are considered those that result directly from interception of spray droplets or dermal contact with foliar residues. The direct effect of sulfoxaflor on these measures at the maximum application rate in the US is presently not known. When compared to control hives, the effect of sulfoxaflor on honey bee colony strength when

applied at 3-32% of the US maximum proposed rate was not apparent in most cases. When compared to hives prior to pesticide application, sulfoxaflor applied to cotton foliage up to the maximum rate proposed in the US resulted in no discernible decline in mean colony strength by 17 days after the first application. Longer-term results were not available from this study nor were concurrent controls included. For managed bees, the primary exposure routes of concern include direct contact with spray droplets, dermal contact with foliar residues, and ingestion through consumption of contaminated pollen, nectar and associated processed food provisions. Exposure of hive bees via contaminated wax is also possible. Exposure of bees through contaminated drinking water is not expected to be nearly as important as exposure through direct contact or pollen and nectar.

In summary, sulfoxaflor is slightly toxic to practically non-toxic to fish and freshwater water aquatic invertebrates on an acute exposure basis. It is also practically non-toxic to aquatic plants (vascular and non-vascular). Sulfoxaflor is highly toxic to saltwater invertebrates on an acute exposure basis. The high toxicity of sulfoxaflor to mysid shrimp and benthic aquatic insects relative to the water flea is consistent with the toxicity profile of other insecticides with similar MOAs. For birds and mammals, sulfoxaflor is classified as moderately toxic to practically non-toxic on an acute exposure basis. The threshold for chronic toxicity (NOAEL) to birds is 200 ppm and that for mammals is 100 ppm in the diet. Sulfoxaflor did not exhibit deleterious effects to terrestrial plants at or above its proposed maximum application rates.

For bees, sulfoxaflor is classified as very highly toxic. However, if this insecticide is strictly used as directed on the Section 18 supplemental label, no significant adverse effects are expected to Texas wildlife. Of course, standard precautions to avoid drift and runoff to waterways of the state are warranted. As stated on the Section 3 label, risk to managed bees and native pollinators from contact with pesticide spray or residues can be minimized when applications are made before 7 am or after 7 pm or when the temperature is below 55°F at the site of application.

Environmental Fate

Sulfoxaflor is a systemic insecticide which displays translaminar movement when applied to foliage. Movement of sulfoxaflor within the plant follows the direction of water transport within the plant (i.e., xylem mobile) as indicated by phosphor translocation studies in several plants. Sulfoxaflor is characterized by a water solubility ranging from 550 to 1,380 ppm. Sulfoxaflor has a low potential for volatilization from dry and wet surfaces (vapor pressure= 1.9×10^{-8} torr and Henry's Law constant= 1.2×10^{-11} atm m^3 $mole^{-1}$, respectively at 25 °C). Partitioning coefficient of sulfoxaflor from octanol to water (K_{ow} @ 20 C & pH 7= 6; Log K_{ow} = 0.802) suggests low potential for bioaccumulation. No fish bioconcentration study was provided due to the low K_{ow}, but sulfoxaflor is not expected to bioaccumulate in aquatic systems. Furthermore, sulfoxaflor is not expected to partition into the sediment due to low K_{oc} (7-74 mL/g).

Registrants tests indicate that hydrolysis, and both aqueous and soil photolysis are not expected to be important in sulfoxaflor dissipation in the natural environment. In a hydrolysis study, the parent was shown to be stable in acidic/neutral/alkaline sterilized aqueous buffered solutions (pH values of 5, 7 and 9). In addition, parent chemical as well as its major degradate, were shown to degrade relatively slowly by aqueous photolysis in sterile and natural pond water ($t^{½}$= 261 to >1,000 days). Furthermore, sulfoxaflor was stable to photolysis on soil surfaces. Sulfoxaflor is

expected to biodegrade rapidly in aerobic soil (half-lives <1 day). Under aerobic aquatic conditions, biodegradation proceeded at a more moderate rate with half-lives ranging from 37 to 88 days. Under anaerobic soil conditions, the parent compound was metabolized with half-lives of 113 to 120 days while under anaerobic aquatic conditions the chemical was more persistent with half-lives of 103 to 382 days. In contrast to its short-lived parent, the major degradate is expected to be more persistent than its parent in aerobic/anaerobic aquatic systems and some aerobic soils. In other soils, less persistence is expected due to mineralization to CO_2 or the formation of other minor degradates.

In field studies, sulfoxaflor has shown similar vulnerability to aerobic bio-degradation in nine out of ten terrestrial field dissipation studies on bare-ground/cropped plots (half-lives were <2 days in nine cropped/bare soils in CA, FL, ND, ON and TX and was 8 days in one bare ground soil in TX). The chemical can be characterized by very high to high mobility (Kf_{oc} ranged from 11-72 mL g^{-1}). Rapid soil degradation is expected to limit chemical amounts that may potentially leach and contaminate ground water. Contamination of groundwater by sulfoxaflor will only be expected when excessive rain occurs within a short period (few days) of multiple applications in vulnerable sandy soils. Contamination of surface water by sulfoxaflor is expected to be mainly related to drift and very little due to run-off. This is because drifted sulfoxaflor that reaches aquatic systems is expected to persist while that reaching the soil system is expected to degrade quickly with slight chance for it to run-off.

When sulfoxaflor is applied foliarly on growing crops it is intercepted by the crop canopy. Data presented above appear to indicate that sulfoxaflor enters the plant and is incorporated in the plant foliage with only limited degradation. It appears that this is the main source of the insecticide sulfoxaflor that would kill sap sucking insects. This is because washed-off sulfoxaflor, that reaches the soil system, is expected to degrade.

In summary, sulfoxaflor has a low potential for volatilization from dry and wet surfaces. This chemical is characterized by relatively higher water solubility. Partitioning coefficient of sulfoxaflor from octanol to water suggests low potential for bioaccumulation in aquatic organisms such as fish. Sulfoxaflor is resistant to hydrolysis and photolysis but transforms quickly in soils. In contrast, sulfoxaflor reaching aquatic systems by drift is expected to degrade rather slowly. Partitioning of sulfoxaflor to air is not expected to be important due to the low vapor pressure and Henry's Law constant for sulfoxaflor. Exposure in surface water results from drifted parent as only minor amounts is expected to run-off only when rainfall and/or irrigation immediately follow application. The use of this insecticide is not expected to significantly adversely impact Texas ecosystems with use according to the Section 18 label with this application. Of course, caution is needed to prevent exposure to water systems because of toxicity issues to aquatic invertebrates. As stated on the Section 3 label, this product should never be applied directly to water, to areas where surface water is present or to intertidal areas below the mean water mark. Do not contaminate water when disposing of equipment rinsates.

Endangered and Threatened Species in Texas

No impacts are expected on endangered and threatened species by this very limited use of this insecticide as delineated in the Section 18 application. Sulfoxaflor demonstrates a very favorable ecotoxicity and fate profile as stated above and should not directly impact any protected

mammal, fish, avian, or plant species. This product does adversely affect insects and aquatic invertebrates, especially bees, but the limited exposure to these species should not negatively affect endangered and threatened species in Texas. As always, the label precautions need be strictly adhered to.

SECTION 166.20(a)(8): COORDINATION WITH OTHER AFFECTED STATE OR FEDERAL AGENCIES

The following state/federal agencies were notified of the Texas Department of Agriculture's (TDA's) actions to submit an application for a specific exemption to EPA

- Texas Commission on Environmental Quality (TCEQ), Air Quality Control
- Texas Commission on Environmental Quality (TCEQ), Water Quality
- Texas Parks and Wildlife Department
- U.S. Fish and Wildlife Department

SECTION 166.20(a)(9): ACKNOWLEDGEMENT BY THE REGISTRANT

Dow AgroScience has been notified of this agency's intent regarding this application (see attached letter of support). They have also provided a copy of a label with the use directions for this use (although this use is dependent upon the approval of this section-18 by EPA).

SECTION 166.20(a)(10): DESCRIPTION OF PROPOSED ENFORCEMENT PROGRAM

The State Legislature has endowed TDA with the authority to regulate the distribution, storage, sale, use and disposal of pesticides in the state of Texas. In addition, the EPA/TDA grant enforcement agreement provides the Department with the authority to enforce the provisions of the FIFRA, as amended, within the state. Therefore, the Department is no lacking in authority to enforce the provisions of an EPA Pesticide Enforcement Specialist will make a number of random, unannounced calls on applicators to check for compliance with provisions of the specific exemption. If violations are discovered appropriate enforcement will be taken.

SECTION 166.20(a)(11): REPEAT USES

This is the second time TDA has applied for this specific exemption.

SECTION 166.20(b)(1): NAME OF THE PEST

Melanaphis sacchari

SECTION 166.20(b)(2): DISCUSSION OF EVENTS OR CIRCUMSTANCES WHICH BROUGHT ABOUT THE EMERGENCY SITUATION

In the fall of 2013, unusually high populations of aphids were discovered near Beaumont, Texas, by Dr. Mo Way. The population was soon detected along the Texas Gulf Coast and the Texas Lower Rio Grande Valley. The aphid soon spread and was identified in Louisiana, Mississippi and Oklahoma. Since it's outbreak in grain sorghum fields, the aphid was identified taxonomically by Dr. Susan Halbert and other homopteran taxonomist as the sugarcane aphid, *Melanaphis sacchari* (SCA), however, this species affecting sorghum might be a new biotype that switched host or a new invasive strain recently introduced into the U.S. This aphid has been found in sorghum (both grain and forage) as well as johnsongrass (*sorghum halepense*) in great numbers successfully reproducing. In 2014, alate SCA forms were detected in fields of sugarcane or corn neighboring heavily infested sorghum fields in the Rio Grande Valley in South Texas. These SCA alates started to deposit nymphs in sugarcane or corn plants, however, nymphs and alates SCA vanished from these plants in two or three days.

Since widespread detection in South Texas and Louisiana in 2013, a Sugarcane Aphid Task Force was formed to effectively communicate and address this pest issue. The pest has since spread to ten states, eight of which have received Section 18 exemptions for the use of sulfoxaflor in sorghum. The issue is further complicated in Texas by the ongoing drought. Recent rains have provided some relief to farmers. However, rice farmers in the Texas Gulf Coast rely on water provided by lakes in the Texas Hill Country. Because of the historically low levels of these lakes, the farmers have been cut off from lake water for the past three years. Rice farmers have relied on other crops like grain sorghum, which requires much less water. This has increased the sorghum acreage in the Texas Gulf Coast. In 2013, over 3 million acres of sorghum was planted in Texas, up from a low of 1.5 million in 2011 (National Agriculture Statistics Service, http://quickstats.nass.usda.gov/results/F3F8C65B-0696-3C91-B805-29F290D1B4FA).

In South Texas, the Sugarcane aphid does not lay eggs, they are viviparous. During the winter months, temperatures in the South Texas only reach a minimum of around 28ºF. During normal cold spells, the daytime temperature rises above 40ºF, which does not hinder the SCA, as they can seek shelter in the abundance of volunteer sorghum and johnsongrass. This provides a valid population as sorghum acreage is planted in February in March in the southernmost areas of Texas. With the last harvest date of late November/early December in some areas, the population has a large timeframe to establish itself. The South Texas area provides an optimal environment for the SCA to overwinter.

The populations of SCA begin feeding on the lower leaves of sorghum plants then rapidly advance to the upper leaves and even colonize in the sorghum head. Mexican scientists reported high populations of the aphid in Mexico in Rio Bravo and San Fernando in the fall of 2013. Unsuccessful treatments including chlorpyrifos, methomyl and cypermethrin were applied in Mexico during 2013. Entire fields were lost in Mexico and Texas A&M AgriLife scientist feared that populations would rapidly spread northward during the 2014 growing season. That

fear came to fruition, as the pest spread into northward into Oklahoma and southern Kansas and on to the Southeastern U.S.

Natural enemies have been observed feeding on the sugarcane aphid, but they apparently had difficulty responding quickly enough to prevent damage. Progress is being made on developing resistant/tolerant sorghum lines, but sufficient quantities of agronomically acceptable cultivars will be years away from commercial use.

SECTION 166.20(b)(3): DISCUSSION OF ANTICIPATED RISKS TO ENDANGERED OR THREATENED SPECIES, BENIFICIAL ORGANISMS, OR THE ENVIRONMENT

As discussed previously, it is not anticipated that there should be any anticipated risks to endangered or threatened species, beneficial organisms or the environment if the application is made according to the section 18 use directions.

See Attachment F - Endangered and Threatened Species List 2011

SECTION 166.20(b)(4): DISCUSSION OF SIGNIFICANT ECONOMIC LOSS

Dr. Michael Brewer, Texas A&M AgriLife Research Specialist in Corpus Christi, has reported losses rangeing from 25 – 75% along the Gulf Coast. Similar yield loss has been reported throughout Texas. Texas A&M AgriLife Extension Specialist have confirmed SCA in most sorghum producing counties of Texas. Dr. Mo Way reported producers in Chambers and Liberty counties did not harvest their grain sorghum because the aphid damage was so severe. He also reported another producer in Liberty County suffered a yield loss of 50% in an infested field as compared to another field where the aphid did not damage the crop. Dr. Raul Villanueva reported two seed increase plots at the Texas A&M AgriLife Center in Weslaco were completely lost due to the aphid in 2013. Dr. Villanueva has also received information from Mexico that research plots at the Rio Bravo Agricultural Station were all devastated by this aphid and the growers had up to 60% loss in San Fernando and Ciudad Victoria.

Below is the 2013 data from Texas A&M AgriLife Extension Service crop budgets.

Region	Irr/dl		CWT	Price $/cwt	$/ac	$/ac w/o Rent
High Plains	dl	Income	18	9.00	162	
		Cost			176.18	146.18
High Plains	irr	Income	60	9.00	540.00	
		Cost			572.00	472.00
Rolling Plains	dl	Income	22	11.10	244.20	

		Cost			152.53	117.53
Blacklands	dl	Income	45	10.00	450.00	
		Cost			299.73	254.85
Coastal Bend	dl	Income	40	10.00	400.00	
		Cost			302.00	190.50

The cost of production for grain sorghum is approximately $325-$375 per acre. According to the Texas Almanac, the avg yield of grain sorghum in Texas in 2010, 2011 and 2012 was 70, 49 and 59 bu/acre, respectively, for a 3-year avg of approximately 59 bu/acre (56 lb/bu for grain sorghum) which is about 3300 lb/acre. The avg price for grain sorghum in Texas in 2010, 2011 and 2012 was approximately $7.26, $10.40 and $11.20/cwt. The current price for grain sorghum is about $7.50/cwt. Also, the relatively slim profit margin means unexpected and uncontrolled pest infestations, like the sugarcane aphid, can have a devastating impact on the profitability of the crop.

Attachment A

2014 Grain Sorghum Insecticide Efficacy Trials

Texas A&M AgriLife Extension Service

Sugarcane Aphid Control with Foliar Insecticides in Grain Sorghum

Trial ID: 14GS05 Location: Calhoun County Trial Year: 2014
Protocol ID: 14GS05 Investigator: Stephen Biles
Project ID: Study Director:
Sponsor Contact:

Trt No.	Treatment Name	Rate	Rate Unit	1	4	7	10	2	5	8	11	3
Pest Type				I Insect	I Insect	I Insect	I Insect	I Insect	I Insect	I Insect	I Insect	I Insect
Pest Code				MELHSA	MELHSA	MELHSA	MELHSA	MELHSA	MELHSA	MELHSA	MELHSA	MELHSA
Pest Scientific Name				Melanaphis sac>	Melanaphis sac>	Melanaphis sac>	Melanaphis sac>	Melanaphis sac>	Melanaphis sac>	Melanaphis sac>	Melanaphis sac>	Melanaphis sac>
Pest Name				Sugarcane aphid	Sugarcane aphid	Sugarcane aphid	Sugarcane aphid	Sugarcane aphid	Sugarcane aphid	Sugarcane aphid	Sugarcane aphid	Sugarcane aphid
Crop Code				SORVU	SORVU	SORVU	SORVU	SORVU	SORVU	SORVU	SORVU	SORVU
BBCH Scale				BGRM	BGRM	BGRM	BGRM	BGRM	BGRM	BGRM	BGRM	BGRM
Crop Scientific Name				Sorghum bicolor	Sorghum bicolor	Sorghum bicolor	Sorghum bicolor	Sorghum bicolor	Sorghum bicolor	Sorghum bicolor	Sorghum bicolor	Sorghum bicolor
Crop Name				Grain sorghum	Grain sorghum	Grain sorghum	Grain sorghum	Grain sorghum	Grain sorghum	Grain sorghum	Grain sorghum	Grain sorghum
Description				Upper Leaf	Upper Leaf	Upper Leaf	Upper Leaf	Lower Leaf	Lower Leaf	Lower Leaf	Lower Leaf	Average
Rating Date				6/5/2014	6/9/2014	6/12/2014	6/19/2014	6/5/2014	6/9/2014	6/12/2014	6/19/2014	6/5/2014
Rating Type				COUNT	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT	COUNT
Rating Unit				/leaf	/leaf	/leaf	/leaf	/leaf	/leaf	/leaf	/leaf	/leaf
Number of Subsamples				1	1	1	1	1	1	1	1	1
Days After First/Last Applic.				-1 -1	3 3	6 6	13 13	-1 -1	3 3	6 6	13 13	-1 -1
Trt-Eval Interval				-1 DA-A	3 DA-A	6 DA-A	13 DA-A	-1 DA-A	3 DA-A	6 DA-A	13 DA-A	-1 DA-A
ARM Action Codes												
Number of Decimals				2	2	2	2	2	2	2	2	2
1	Transform	0.75	oz/a	114.30 a	0.83 a	0.10 a	0.00 a	386.85 a	160.63 bc	0.21 b	0.03 a	250.58 a
2	Transform	1	oz/a	74.55 a	0.98 a	0.05 a	0.00 a	507.35 a	164.08 bc	0.10 b	0.03 a	290.95 a
3	Nufos	1	qt/a	123.00 a	0.28 a	0.13 a	0.00 a	482.65 a	28.83 c	0.23 b	0.03 a	302.83 a
4	Dimethoate	1	pt/a	42.20 a	61.73 a	27.65 a	0.00 a	427.10 a	473.93 a	88.83 a	0.00 a	234.65 a
5	Endego	5	oz/a	90.70 a	3.14 a	0.47 a	0.00 a	622.65 a	307.70 ab	30.18 b	0.24 a	356.68 a
6	Centric	2.5	oz/a	99.17 a	9.38 a	0.28 a	0.00 a	455.75 a	135.20 bc	3.40 b	0.08 a	277.46 a
7	Sivanto	8	oz/a	65.35 a	0.25 a	0.03 a	0.00 a	598.35 a	140.55 bc	0.15 b	0.00 a	331.85 a
8	Untreated Check			122.90 a	193.48 a	11.38 a	0.00 a	530.40 a	220.35 bc	38.48 ab	0.03 a	326.65 a
LSD (P=.05)				108.142	176.450	20.247	0.000	257.888	197.912	54.776	0.162	159.331
Standard Deviation				73.527	119.970	13.766	0.000	175.341	134.563	37.243	0.110	108.331
CV				80.34	355.41	274.81	0.0	34.97	65.99	184.41	211.95	36.54
Replicate F				12.656	0.834	2.016	0.000	11.204	4.206	2.538	2.394	14.205
Replicate Prob(F)				0.0001	0.4905	0.1425	1.0000	0.0001	0.0177	0.0841	0.0971	0.0001
Treatment F				0.630	1.279	2.091	0.000	0.856	4.002	2.896	2.089	0.591
Treatment Prob(F)				0.7260	0.3075	0.0903	1.0000	0.5555	0.0063	0.0277	0.0905	0.7556

Means followed by same letter do not significantly differ (P=.05, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Texas A&M AgriLife Extension Service

Sugarcane Aphid Control with Foliar Insecticides in Grain Sorghum

Trial ID: 14GS05 Location: Calhoun County Trial Year: 2014
Protocol ID: 14GS05 Investigator: Stephen Biles
Project ID: Study Director:
Sponsor Contact:

Trt No.	Treatment Name	Rate	Rate Unit	I Insect MELHSA Melanaphis sac> Sugarcane aphid SORVU BGRM Sorghum bicolor Grain sorghum Average 6/9/2014 COUNT /leaf 1 3 3 3 DA-A T1 2	I Insect MELHSA Melanaphis sac> Sugarcane aphid SORVU BGRM Sorghum bicolor Grain sorghum Average 6/12/2014 COUNT /leaf 1 6 6 6 DA-A T2 2	I Insect MELHSA Melanaphis sac> Sugarcane aphid SORVU BGRM Sorghum bicolor Grain sorghum Average 6/19/2014 COUNT /leaf 1 13 13 13 DA-A T3 2	Weight 7/10/2014 YIELD LB 1 34 34 47 DA-A TY4 1
				6	9	12	16
1	Transform	0.75	oz/a	80.73 bc	0.00 b	0.01 a	6321.0 a
2	Transform	1	oz/a	82.53 bc	0.00 b	0.01 a	6175.3 a
3	Nufos	1	qt/a	14.55 c	0.00 b	0.01 a	5989.4 a
4	Dimethoate	1	pt/a	267.83 a	58.33 a	0.00 a	5893.4 a
5	Endego	5	oz/a	155.42 ab	15.25 b	0.12 a	6067.6 a
6	Centric	2.5	oz/a	72.29 bc	1.75 b	0.04 a	6107.1 a
7	Sivanto	8	oz/a	70.40 bc	0.00 b	0.00 a	6210.6 a
8	Untreated Check			206.91 a	24.83 ab	0.01 a	5949.0 a
LSD (P=.05)				122.174	36.201	0.081	994.82
Standard Deviation				83.068	24.613	0.055	676.39
CV				69.9	196.61	211.95	11.11
Replicate F				3.754	2.484	2.394	1.925
Replicate Prob(F)				0.0265	0.0888	0.0971	0.1564
Treatment F				4.095	2.830	2.089	0.181
Treatment Prob(F)				0.0056	0.0305	0.0905	0.9865

Texas A&M AgriLife Extension Service

Sugarcane Aphid Control with Foliar Insecticides in Grain Sorghum

Trial ID: 14GS05 Location: Calhoun County Trial Year: 2014
Protocol ID: 14GS05 Investigator: Stephen Biles
Project ID: Study Director:
Sponsor Contact:

Pest Type
I, Insect, G-BYRI7, G-InsStg = Insect
Pest Code
MELHSA, Melanaphis sacchari, = US
Crop Code
SORVU, BGRM, Sorghum bicolor, = US
Rating Type
COUNT = count
YIELD = yield
Rating Unit
LB = pound
ARM Action Codes
T1 = ([C4]+[C5])/2
T2 = ([C8]+[C7])/2
T3 = ([C10]+[C11])/2
TY4 = 3.032655*[C13]*(100-[C15])/86

Texas A&M AgriLife Extension Service

Sugarcane Aphid Control with Foliar Insecticides in Grain Sorghum near Harvest

Trial ID: 14GS08c Location: Calhoun County Trial Year: 2014
Protocol ID: 14GS05 Investigator: Stephen Biles
Project ID: Study Director:
Sponsor Contact:

Description		Flag Leaf	Flag Leaf	Flag Leaf	Flag Leaf	Head	Flag Leaf	Head
Rating Date		7/11/2014	7/14/2014	7/18/2014	7/21/2014	7/21/2014	7/25/2014	7/25/2014
Rating Type		COUINS	COUINS	COUINS	COUINS	COUINS	COUINS	COUINS
Rating Unit		/leaf	/leaf	/leaf	/leaf	/head	/leaf	/head
Number of Subsamples		1	1	1	1	1	10	10
Days After First/Last Applic.		0 0	3 3	7 7	10 10	10 10	14 14	14 14
Trt-Eval Interval		0 DA-A	3 DA-A	7 DA-A	10 DA-A	10 DA-A	14 DA-A	14 DA-A
Number of Decimals		1	1					
Trt No.	Treatment Name	Rate Rate Unit	1	2	3	4	5	6	7
1	Transform	0.75 oz/a	393.9 a	11.1 b	9.275 b	24.950 b	2.500 b	25.8 b	2.4 a
2	Centric	2.5 oz/a	276.1 a	3.9 b	0.000 b	0.275 b	0.000 b	0.0 b	0.0 a
3	Endego	5 oz/a	502.8 a	0.7 b	0.525 b	1.350 b	9.000 b	17.7 b	22.0 a
4	Sivanto	8 oz/a	323.7 a	1.6 b	0.000 b	0.000 b	0.025 b	0.5 b	0.0 a
5	Untreated Check		408.5 a	250.2 a	180.223 a	155.955 a	61.318 a	89.1 a	11.9 a
LSD (P=.10)			181.46	96.47	71.8441	85.6620	32.7439	56.49	24.22
Standard Deviation			144.01	76.56	57.0162	67.9822	25.9859	44.83	19.22
CV			37.8	143.13	150.02	186.22	178.37	168.39	264.75
Replicate F			3.494	1.033	1.137	0.551	0.938	0.538	0.907
Replicate Prob(F)			0.0498	0.4128	0.3736	0.6569	0.4524	0.6655	0.4664
Treatment F			1.449	8.266	7.796	3.956	4.126	2.672	0.998
Treatment Prob(F)			0.2777	0.0019	0.0025	0.0284	0.0249	0.0838	0.4459

Rating Type
COUINS = count - insect

Means followed by same letter do not significantly differ (P=.10, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Texas A&M AgriLife Extension Service

Management of Sugarcane Aphids Near Harvest

Trial ID: 14GS09 Location: Victoria County Trial Year: 2014
Protocol ID: 14GS09 Investigator: Stephen Biles
Project ID: Study Director:
Sponsor Contact:

Description			Aphids/ Flag L>	Aphids/Head	Aphids/ Flag L>	Aphids/Head
Rating Date			7/23/2014	7/23/2014	7/28/2014	7/28/2014
Number of Subsamples			10	10	10	10
Days After First/Last Applic.			0 0	0 0	5 5	5 5
Trt-Eval Interval			0 DA-A	0 DA-A	5 DA-A	5 DA-A
Trt No.	Treatment Name	Rate / Rate Unit	1	2	3	4
1	Transform	0.75 oz/a	225.0 a	2.0 a	0.1 b	0.0 a
2	Transform RoundUp Powermax	0.75 oz/a 32 oz/a	207.2 a	1.4 a	0.0 b	0.1 a
3	RoundUp Powermax	32 oz/a	293.5 a	1.3 a	48.6 b	13.8 a
4	Untreated Check		237.2 a	2.6 a	120.1 a	1.0 a
LSD (P=.10)			63.80	3.12	54.77	13.13
Standard Deviation			49.22	2.40	42.26	10.13
CV			20.45	131.76	100.15	273.79
Replicate F			2.239	0.414	2.421	0.930
Replicate Prob(F)			0.1530	0.7470	0.1331	0.4653
Treatment F			2.290	0.223	7.214	1.766
Treatment Prob(F)			0.1471	0.8782	0.0091	0.2234

Means followed by same letter do not significantly differ (P=.10, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Attachment B

Sorghum Insecticide Screening for 2014 Annual Report

Sorghum Insecticide Screening

Blocks 8N and 8S
Beaumont, TX
2014

PLOT PLAN

← North **Block 8N**

I				II			
1	**1**	*6*	**6**	*11*	**9**	*16*	**5**
2	**2**	*7*	**7**	*12*	**7**	*17*	**1**
3	**3**	*8*	**8**	*13*	**4**	*18*	**6**
4	**4**	*9*	**9**	*14*	**2**	*19*	**8**
5	**5**	*10*	**Blank**	*15*	**3**	*20*	**Blank**
Block 8S							
III				**IV**			
1	**8**	*6*	**3**	*11*	**4**	*16*	**5**
2	**9**	*7*	**7**	*12*	**2**	*17*	**7**
3	**5**	*8*	**2**	*13*	**8**	*18*	**1**
4	**4**	*9*	**6**	*14*	**6**	*19*	**3**
5	**1**	*10*	**Blank**	*15*	**9**	*20*	**Blank**

Plot size: 4 rows, 30 inch row spacing, 20 ft long

Variety: Dekalb S53-67

Note: smaller numbers in *italics* are plot numbers

TREATMENT DESCRIPTIONS, RATES AND TIMINGS

Treatment no.	Flag color	Description	Rate (fl oz/A)

1	Red	Transform WG[a]	0.75 oz/A
2	White	Transform WG[a]	1.5 oz/A
3	Blue	Lorsban Advanced[a]	24
4	Light green	Sivanto[b]	5
5	Yellow	Dimethoate 4EC[a]	16
6	Green	Endigo ZCX[b]	5
7	Orange	Fulfill[c]	5 oz/A
8	Pink	Centric 40WG[b]	2.5 oz/A
9	2 white	Untreated	---

[a] Also includes COC @ 1% v/v

[b] Also includes NIS @ 0.25% v/v

[c] Also includes MSO @ 1% v/v

Agronomic and Cultural Information

Experimental design: Randomized complete block with 9 treatments and 4 replications

Planting: Drill-planted test into League soil (pH 5.5, sand 3.2%, silt 32.4%, clay 64.4%, and organic matter 3.8 - 4.8%) on May 21

Plot size = 4 rows, 30 inch row spacing, 20 ft long

Emergence on May 29

Irrigation: Flushed blocks (temporary flood, immediate drain) on May 22

Note: Plots were flushed as needed; this was an irrigated experiment

Fertilization: *All fertilizer (urea) was distributed by hand.*

15 lb N/A on May 22 at planting

80 lb N/A on Jul 28

Herbicide: AAtrex 4L @ 2.3 pt/A and Dual II Magnum @ 1 pt/A with a 2-person hand-held spray boom (13- 80015 nozzles, 50 mesh screens, 16 gpa final spray volume) on May 22 for weed control

Treatments: All seed treated with Concept III (safener)

Applied AV-1011 @ 2 gal/A (bird repellent) on Aug 15

Applied treatments 1 - 8 on Sep 24 with a 3-nozzle spray boom (800067 tips, 50 mesh screens, 25 gpa final spray volume)

Sampling: Sorghum 30% headed on Aug 4 and 100% headed on Aug 11

Infested all plots with sugarcane aphid (SA) on Aug 22: SA-infested leaves (from sweet sorghum) were paper clipped to sorghum leaves (2 per plot); artificial infestation not effective

Natural infestations of SA beginning to increase on Aug 22

Counted number of SA on 10 leaves (1 leaf per plant) per plot on Sep 23 (pretreatment) and Oct 3

Counted number of SA on 20 leaves (1 leaf per plant) per plot on Sep 26, Sep 29 and Oct 10

Removed and weighed 20 seed heads from each plot on Oct 22

Discussion

The experiment was planted late in hopes of encouraging sugarcane aphid (SA) populations. The experiment was planted in 2 blocks normally reserved for rice experiments; thus, we were able to irrigate our grain sorghum plots when needed (blocks were flush irrigated---temporary flood immediately followed by draining). We selected the hybrid variety Dekalb S53-67 based on observations by local farmers who grew this variety in 2013 and experienced problems with SA.

We did not observe any SA in plots until grain sorghum was well past heading (late August). Unfortunately, blackbird pressure was severe, so our yield data are suspect and unreliable. However, in mid-August, we applied AV-1011 to all plots. AV-1011 is a bird repellent manufactured by Arkion Life Sciences. Although AV-1011 is not registered on grain sorghum, the application was made to our research plots which are exempt from registration requirements. Following the experiment, grain sorghum heads as well as vegetation were destroyed and did not enter the food chain. We did not observe many birds in plots after application of AV-1011, so we believe the repellent was effective. We plan on applying AV-1011 in the future to our grain sorghum research plots. In addition, we did not observe any AV-1011 effects on SA populations. To complicate yield losses further, we did not specifically control any other insect pests, such as stink bugs, head worms and sorghum midge which were not monitored, but probably were present in the plots.

Counting SAs in the field is not exact. With experience, we were able to estimate SA populations by counting aphids in groups of 10. Pretreatment counts were not significantly different among treatments (Table 1). Counts 2, 5 and 9 days after treatment (DAT) showed significantly lower populations (compared to the untreated) in the following treatments: Transform WG (both rates), Sivanto, Endigo ZCX, and Centric 40WG. At 16 DAT, populations in the untreated were low, so results are not reliable. Data suggest the low rate of Transform WG performed as well as the high rate. Although Lorsban Advanced, Dimethoate 4EC and Fulfill treatments did not perform as well as the other treatments, they did reduce SA populations.

Table 1. Mean data for sorghum insecticide screening study. Beaumont, TX. 2014.

Treatment	Rate (fl oz/A)	No. sugarcane aphid/leaf[a]					Wet wt./seed head (g)
		Pret.	2 DAT	5 DAT	9 DAT	16 DAT	
Transform WG[b]	0.75 oz/A	20.7	4.8 d	1.8 d	1.1 cd	0.6 bc	21.3
Transform WG[b]	1.5 oz/A	57.8	7.9 cd	2.8 d	0.2 d	0 c	22.1
Lorsban Advanced[b]	24	20.6	21.2 abc	25.9 ab	15.1 a-d	8.6 bc	18.5
Sivanto[c]	5	39.9	2.5 d	10.7 cd	0.4 d	0.7 bc	18.1
Dimethoate 4EC[b]	16	40.1	16.9 a-d	16.4 abc	16.8 abc	24.8 a	20.5
Endigo ZCX[c]	5	65.1	10.3 bcd	14.4 bcd	1.4 bcd	2.4 bc	21.2
Fulfill[d]	5 oz/A	56.4	31.2 ab	24.4 abc	24.0 ab	2.2 bc	20.9
Centric 40WG[c]	2.5 oz/A	43.9	8.0 cd	6.9 bcd	0.6 cd	0.2 bc	20.2
Untreated	---	67.6	43.5 a	46.2 a	36.7 a	10.0 b	19.6
		NS					NS

[a] Pret. = pretreatment; DAT = days after treatment

[b] Also includes COC @ 1% v/v

[c] Also includes NIS @ 0.25% v/v

[d] Also includes MSO @ 1% v/v

Means in a column followed by the same or no letter are not significantly (NS) different (P = 0.05, ANOVA and LSD)

Attachment C

Dr. Way ALL DATA for Sorghum Insecticide Screening

ALL DATA for Sorghum Insecticide Screening

A = block
B = plot
number
C = treatment
number
D = replication
number
E = number of sugarcane aphids in 10 leaves on Sep 23
EH = number of sugarcane aphids per leaf on Sep 23
F = number of sugarcane aphids in 20 leaves on Sep 26
FH = number of sugarcane aphids per leaf on Sep 26
G = number of sugarcane aphids in 20 leaves on Sep 29
GH = number of sugarcane aphids per leaf on Sep 29
H = number of sugarcane aphids in 10 leaves on Oct 3
HH = number of sugarcane aphids per leaf on Oct 3
I = number of sugarcane aphids in 20 leaves on Oct 10
IH = number of sugarcane aphids per leaf on Oct 10
J = wet wt. (g) of seed head on Oct 22 (average of 20 seed heads)

A	B	C	D	E	EH	F	FH	G	GH	H	HH	I	IH	wet wt	J
8N	1	1	1	695	69.5	159	8.0	1	0.1	0	0.0	0	0.0	288.5	14.4
8N	17	1	2	32	3.2	77	3.9	70	3.5	5	0.5	2	0.1	352.5	17.6
8S	5	1	3	45	4.5	13	0.7	62	3.1	38	3.8	34	1.7	488.3	24.4
8S	18	1	4	55	5.5	130	6.5	12	0.6	1	0.1	7	0.4	576	28.8
8N	2	2	1	1130	113.0	392	19.6	9	0.5	0	0.0	0	0.0	304.8	15.2
8N	14	2	2	1060	106.0	201	10.1	19	1.0	0	0.0	0	0.0	283.8	14.2
8S	8	2	3	85	8.5	36	1.8	192	9.6	7	0.7	0	0.0	560.7	28.0
8S	12	2	4	37	3.7	3	0.2	2	0.1	2	0.2	0	0.0	622.1	31.1
8N	3	3	1	167	16.7	854	42.7	672	33.6	0	0.0	4	0.2	275.2	13.8
8N	15	3	2	150	15.0	236	11.8	458	22.9	80	8.0	0	0.0	235.4	11.8
8S	6	3	3	58	5.8	370	18.5	195	9.8	253	25.3	679	34.0	393.4	19.7
8S	19	3	4	450	45.0	238	11.9	743	37.2	271	27.1	1	0.1	569.9	28.5
8N	4	4	1	890	89.0	2	0.1	0	0.0	0	0.0	0	0.0	279.1	14.0
8N	13	4	2	340	34.0	97	4.9	765	38.3	16	1.6	0	0.0	347.5	17.4
8S	4	4	3	65	6.5	37	1.9	64	3.2	0	0.0	4	0.2	360	18.0
8S	11	4	4	300	30.0	64	3.2	22	1.1	0	0.0	51	2.6	456.2	22.8
8N	5	5	1	1040	104.0	806	40.3	466	23.3	0	0.0	0	0.0	231.9	11.6
8N	16	5	2	295	29.5	34	1.7	215	10.8	404	40.4	482	24.1	458	22.9
8S	3	5	3	45	4.5	100	5.0	330	16.5	112	11.2	981	49.1	444.7	22.2
8S	16	5	4	223	22.3	408	20.4	302	15.1	125	15.6	516	25.8	506.3	25.3
8N	6	6	1	1320	132.0	390	19.5	692	34.6	0	0.0	0	0.0	440.4	22.0
8N	18	6	2	1080	108.0	215	10.8	62	3.1	2	0.2	55	2.8	352.3	17.6
8S	9	6	3	155	15.5	174	8.7	179	9.0	50	5.0	99	5.0	478.3	23.9
8S	14	6	4	50	5.0	43	2.2	216	10.8	5	0.5	33	1.7	424.7	21.2
8N	7	7	1	1520	152.0	1554	77.7	1139	57.0	0	0.0	1	0.1	270.2	13.5
8N	12	7	2	250	25.0	447	22.4	543	27.2	735	73.5	7	0.4	446.4	22.3
8S	7	7	3	60	6.0	222	11.1	257	12.9	201	20.1	140	7.0	375.9	18.8
8S	17	7	4	425	42.5	271	13.6	12	0.6	25	2.5	22	1.1	577	28.9
8N	8	8	1	1110	111.0	387	19.4	172	8.6	0	0.0	1	0.1	373.7	18.7
8N	19	8	2	505	50.5	192	9.6	155	7.8	25	2.5	10	0.5	300.1	15.0
8S	1	8	3	105	10.5	14	0.7	91	4.6	0	0.0	1	0.1	467.1	23.4
8S	13	8	4	35	3.5	48	2.4	132	6.6	0	0.0	1	0.1	470	23.5
8N	9	9	1	2160	216.0	1942	97.1	1365	68.3	0	0.0	0	0.0	277.9	13.9
8N	11	9	2	475	47.5	1275	63.8	1486	74.3	960	96.0	0	0.0	485.6	24.3
8S	2	9	3	50	5.0	116	5.8	679	34.0	56	5.6	436	21.8	364.8	19.2
8S	15	9	4	20	2.0	148	7.4	165	8.3	450	45.0	360	18.0	417.5	20.9
8N	10	Blank	1												
8N	20	Blank	2												
8S	10	Blank	3												
8S	20	Blank	4												

Attachment D

Brewer Data

Sampling Strategies and Action Thresholds for Sugarcane Aphid on Grain Sorghum

Michael Brewer
Texas A&M AgriLife Research
Department of Entomology

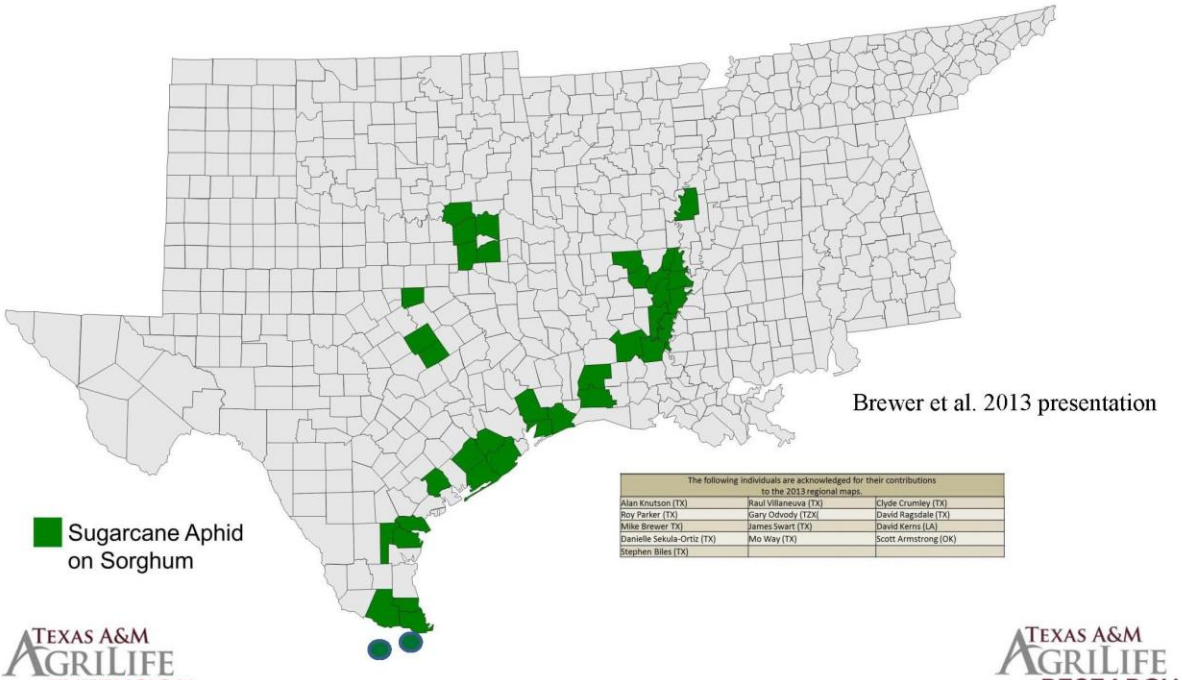
http://ccag.tamu.edu/entomology/
mjbrewer@ag.tamu.edu
361-265-9201

TEXAS A&M AGRILIFE RESEARCH

TEXAS A&M UNIVERSITY

2013 Sugarcane Aphid Occurrence on Sorghum
End of August

some unconfirmed detections in 2012

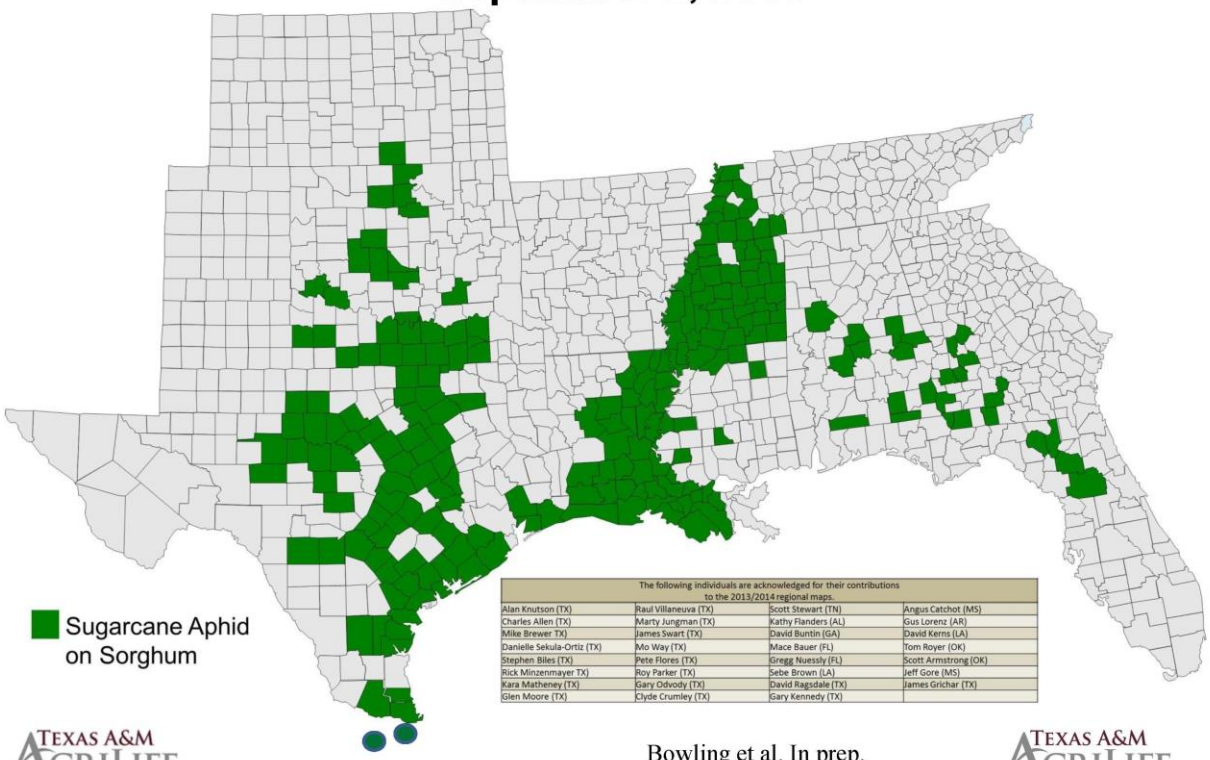


The following individuals are acknowledged for their contributions to the 2013 regional maps.		
Alan Knutson (TX)	Raul Villaneuva (TX)	Clyde Crumley (TX)
Roy Parker (TX)	Gary Odvody (TZX)	David Ragsdale (TX)
Mike Brewer TX)	James Swart (TX)	David Kerns (LA)
Danielle Sekula-Ortiz (TX)	Mo Way (TX)	Scott Armstrong (OK)
Stephen Biles (TX)		

TEXAS A&M AGRILIFE EXTENSION

TEXAS A&M AGRILIFE RESEARCH

2014 Sugarcane Aphid Occurrence on Sorghum
September 2, 2014



The following individuals are acknowledged for their contributions to the 2013/2014 regional maps.			
Alan Knutson (TX)	Raul Villaneuva (TX)	Scott Stewart (TN)	Angus Catchot (MS)
Charles Allen (TX)	Marty Jungman (TX)	Kathy Flanders (AL)	Gus Lorenz (AR)
Mike Brewer TX)	James Swart (TX)	David Buntin (GA)	David Kerns (LA)
Danielle Sekula-Ortiz (TX)	Mo Way (TX)	Mace Bauer (FL)	Tom Royer (OK)
Stephen Biles (TX)	Pete Flores (TX)	Gregg Nuessly (FL)	Scott Armstrong (OK)
Rick Minzenmayer TX)	Roy Parker (TX)	Sebe Brown (LA)	Jeff Gore (MS)
Kara Matheney (TX)	Gary Odvody (TX)	David Ragsdale (TX)	James Grichar (TX)
Glen Moore (TX)	Clyde Crumley (TX)	Gary Kennedy (TX)	

TEXAS A&M AGRILIFE EXTENSION

Bowling et al. In prep.

TEXAS A&M AGRILIFE RESEARCH

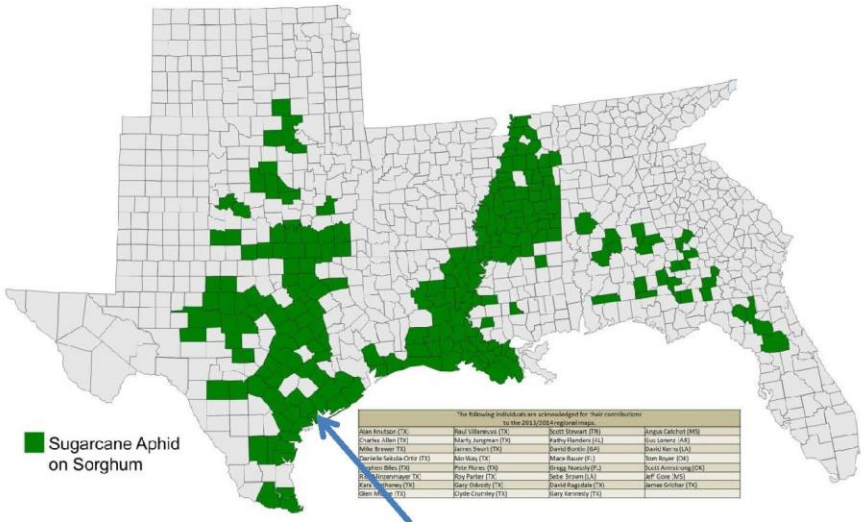
Early Monitoring Off-crop: where/when to look

Preplant/first emergence: Inspect remnant sorghum and johnson grass for winter survivors and winged aphids as first signs of possible wind-aided movement to newly planted fields

Must exist on green living plant material during fall/winter

Detected on sorghum regrowth and green stalk near and in head, Corpus Christi and Lower Texas Gulf Coast, 2014 Jan/Feb;

Detected on johnson grass (→), Jan 2014; none detected further north on Texas coastline



TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

On-crop (emergence to head elongation):

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

- Weekly Fast Detection sampling

  Inspect plant bottom to top, underside of leaves, look for honeydew

  50 foot row lengths near field edge and at least 25 feet into field,

  check each side of field, and any locations near johnson grass

- If expanding colonies and honey dew toward bottom of plant
  Go to twice weekly Delineation sampling (density estimation)
- If new colonies/winged aphid toward top of plant ONLY
  Go to at least weekly Delineation sampling (density estimation)
- If no detection, Continue weekly detects

G. Odvody/M. Brewer, AgriLife Research

T. Ahrens, Del Mar College

M. Way/M. Brewer, AgriLife Research

On-crop (Head emergence to soft dough):

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://coag.tamu.edu/entomology/

- Weekly Quick Delineation monitoring on sorghum (density estimation)
  - Use quick aphid/leaf checker, compare against thresholds (veg stage)
  - If below threshold, recheck twice per week
- When head emerged and below threshold
  - If expanding colonies moving onto stalk/head
    estimate density, consider need for head protection spray
  - If only new colonies/winged aphid toward top of plant
    continue weekly Quick Delineation monitoring

G. Odvody/M. Brewer, AgriLife Research T. Ahrens, Del Mar College

Quick Aphid/leaf ck (20-40 leaves per spot, half top, half bottom)

0-10: actual count
A: 11-25 aphids
B: 26-50 aphids
C: 51-100 aphids
D: 101-500 aphids
E: 501-1,000 aphids
F: > 1,000 aphids

Predatory beetles and flies, and parasitoids (black mummies) have been observed, limiting aphid increase late season

M. Brewer, J. Woolley, G. Odvody, S. Biles, D. Kerns, R. Villanueva

R. Villanueva, AgriLife Extension

M. Brewer, AgriLife Research

T. Ahrens, Del Mar College

R. Villanueva, AgriLife Extension

T. Ahrens, Del Mar College

Courtesy D. Kazmer, USDA ARS

Aphelinus sp.
(to be determined)
J. Woolley et al.

- Many species
- Become abundance, but after aphid is above threshold in (S) sorghum

Texas A&M AgriLife Research
M. Brewer
http://ccag.tamu.edu/entomology/

Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Location: Corpus Christi
Planted: April 11, 2014, emerged on April 16
Plot size: 40 ft by 4 rows, data taken on inner two rows
Randomized complete block of two factors: thresholds and hybrid background
Aphids: First arrivals at 5 to 6 leaf stage of plant development

Triggers for foliar insecticide use (one application):
50, 100, 250, and 500 aphids per leaf and an unsprayed control (UTC)
Transform (sulfoxaflor) 0.75 oz per acre, 14 GPA, hollow tips (ConeJet TX-12)
Hybrids: Susceptible sorghum (S, ATX2752 x RTX430) and a
Putative resistance sorghum (R, ATX2752 x RTX2783)

T. Ahrens, Del Mar College

ET =UTC (S, #205)

Threshold/IPM Tactic Compatibility Study

Measurements: Data taken weekly
Aphid density (aphid/leaf)
20 leaves per plot,
10 top-half, 10 bottom-half
used quick aphid checker
(5-10 min per plot)

Quick Aphid/leaf ck
0-10: actual count
A: 11-25 aphids
B: 26-50 aphids
C: 51-100 aphids
D: 101-500 aphids
E: 501-1,000 aphids
F: > 1,000 aphids

Percent of leaves with
aphelinid mummies (parasitoids)
lady beetle adults or larvae

Percent of leaves with sooty mold (mold)
Yield (bushels/acre)

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Threshold/IPM Tactic Compatibility Study
Results in Pictures, Non-resistant sorghum

Action =UTC (S)

Action = 50 and 100 (S), 2 wk post app.
Few aphids, no injury, no yield loss,
natural enemies reduced

T. Ahrens,
Del Mar College

Action = 250 (S), 2 wk post app.
Modest aphids, modest sooty mold,
no yield loss, abundant enemies

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Threshold/IPM Tactic Compatibility Study
Results in Pictures, Resistant sorghum background

T. Ahrens, Del Mar College

Action =UTC (S)
High aphids and damage visible bottom half of plant

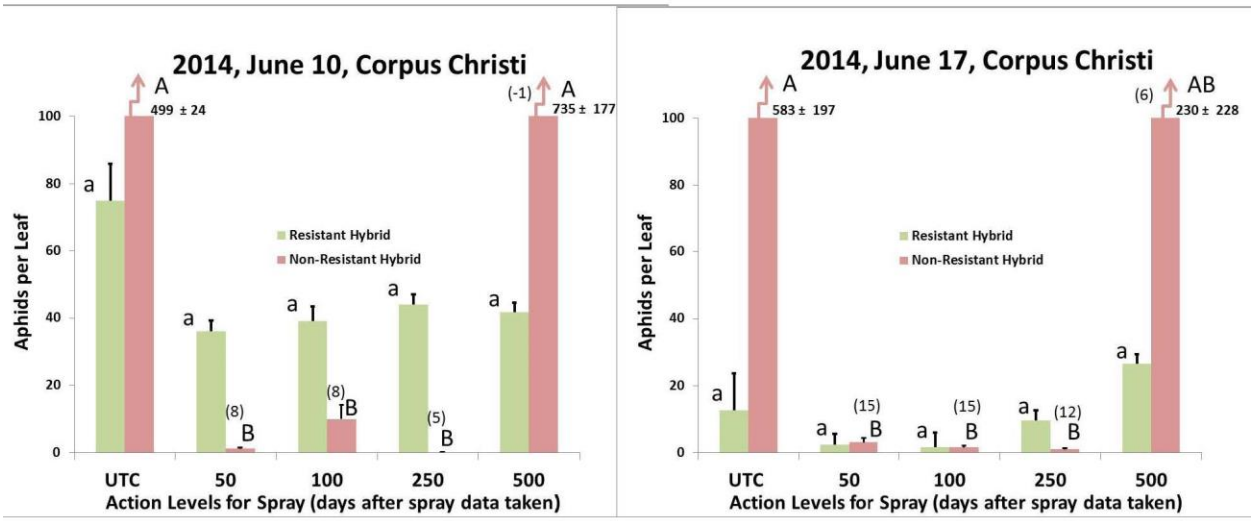
Action = 50 to 500 (R, Tx2783)
Never sprayed

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

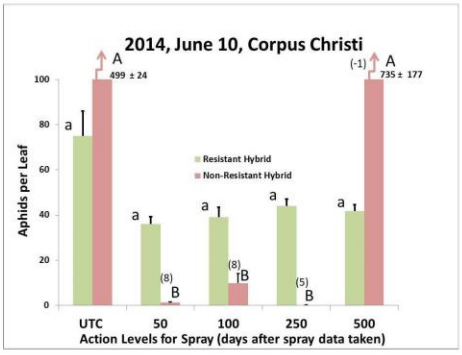
- Action levels of 250 aphids per leaf and lower resulted in consistently low aphid counts through two weeks post application for the non-resistant hybrids.
- Waiting to spray until 500 aphids per leaf resulted in poor aphid suppression.
- Unsprayed plots ranged from 500 to 700 aphids per leaf for a 3 week period.
- The resistant hybrid aphid counts never exceeded the lowest action level of 50 aphids per leaf

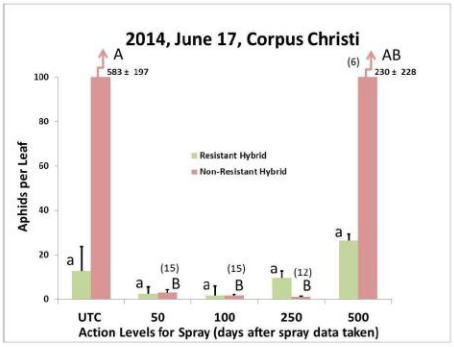


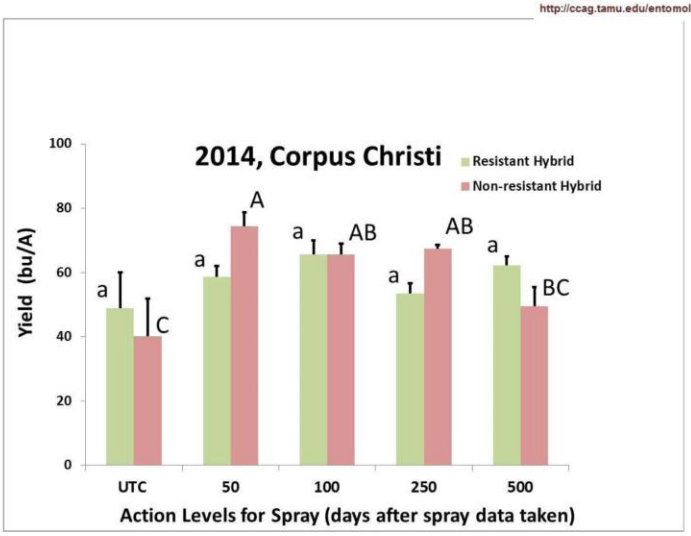
Notes: Plants were at V6 to flag leaf on June 10, and boot to 1/3 bloom on June 17.
Action level triggered Transform (sulfoxaflor) application at the same time for the 50 and 100 aphids per leaf action level on the non-resistant hybrid, three days later for the 250 aphids per leaf action level, and six days later for the 500 aphids per leaf action level.

Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/







- Action levels of 50 to 250 aphids per leaf: resulted in low aphid counts and the highest yield of the non-resistant hybrid.
- Waiting to spray until 500 aphids per leaf resulted in poor aphid suppression and lower yields.
- The resistant hybrid was never sprayed and had yields comparable to the non-resistant sprayed hybrid.

Progression of aphid/leaf after single application (DAT)
Sorghum: Non-resistant (s), one resistant reference included (r)

- Action levels of 50 to 250 aphids per leaf: resulted in low aphid counts for up to 15 days after treatment.
- Waiting to spray until 500 aphids per leaf resulted in poor aphid suppression.
- The resistant hybrid was never sprayed and counts rarely exceeded 50 aphids per leaf

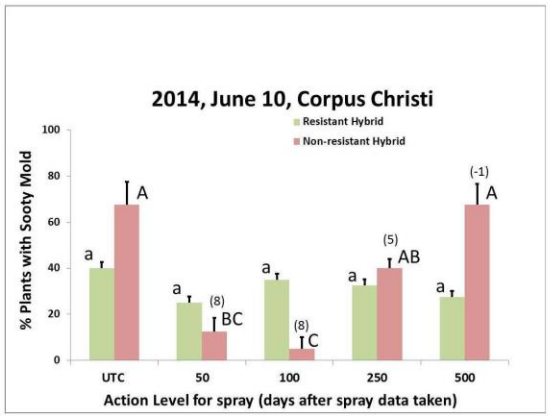
Date/ Growth stage	50(s) MN ± SE (DAT)	100(s) MN ± SE (DAT)	250(s) MN ± SE (DAT)	500(s) MN ± SE (DAT)	UTC(s) MN ± SE (DAT)		UTC(r) MN ± SE (DAT)
May 30/ V6 to V7	143 ± 9.3 A (--)	118 ± 30 A (--)	66.5 ± 25 A (--)	111 ± 43 A (--)	140 ± 80 A (--)		56.6 ± 19 (--)
June 4/ V7 to V8	3.0 ± 1.4 A (2)	4.6 ± 1.8 A (2)	162 ± 76 AB (--)	200 ± 98 AB (--)	239 ± 108 B (--)		83 ± 45 (--)
June 10/ Flag leaf	1.2 ± 0.42 A (8)	9.8 ± 4.2 A (8)	0.1 ± 0.05 A (5)	734 ± 177 B (--)	499 ± 242 B (--)		75 ± 39 (--)
June 17/ Boot-1/3 bloom	3.1 ± 1.2 A (15)	1.6 ± 0.39 A (15)	1.0 ± 0.24 A (12)	230 ± 228 B (6)	583 ± 197 B (--)		13.6 ± 10.6 (--)

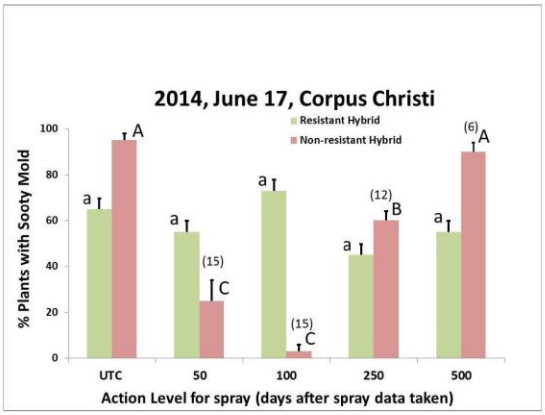
Different letters across a row indicated significant differences. UTC(R) is a reference.
Spray dates: June 2 at 50 &100 aphids/leaf, June 5 at 250 aphids/lf, and June 11 at 500 aphids/leaf.

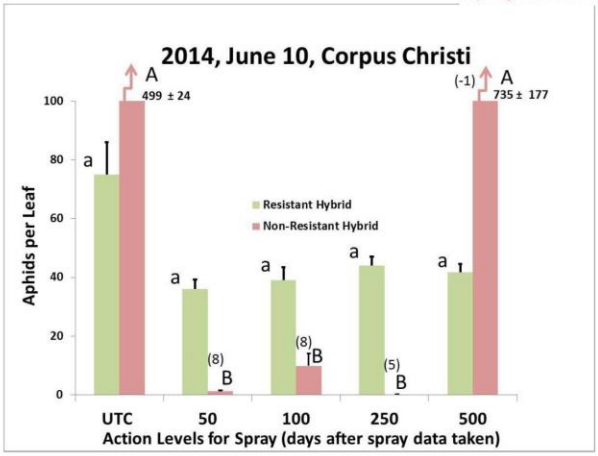
TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/



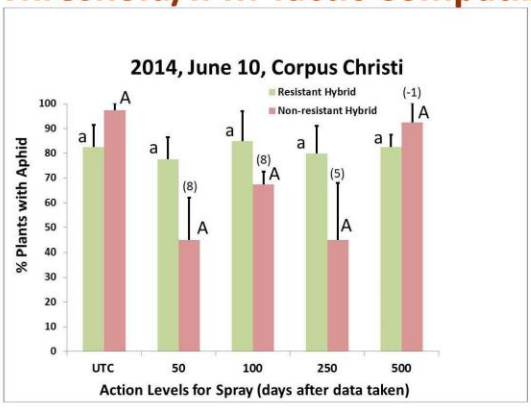


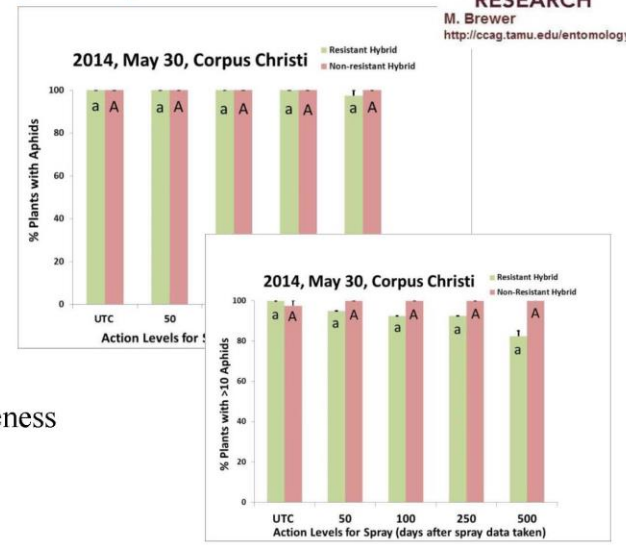


- Action levels of 100 aphids per leaf and lower resulted in low sooty mold in non-resistant hybrids, reflecting low aphids.
- The action level of 250 aphids per leaf resulted in low aphid counts five days post-treatment but sooty mold was high.
- The resistant hybrid was never sprayed and sooty mold was common (but yields were fine).

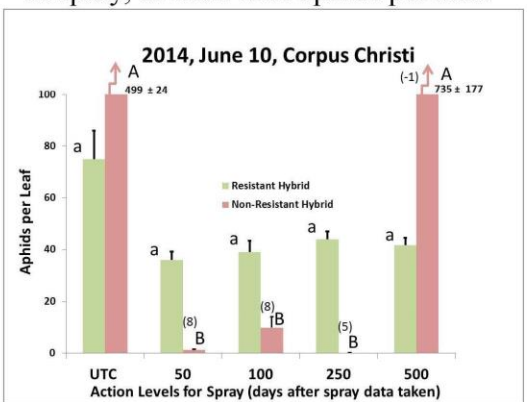
Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/





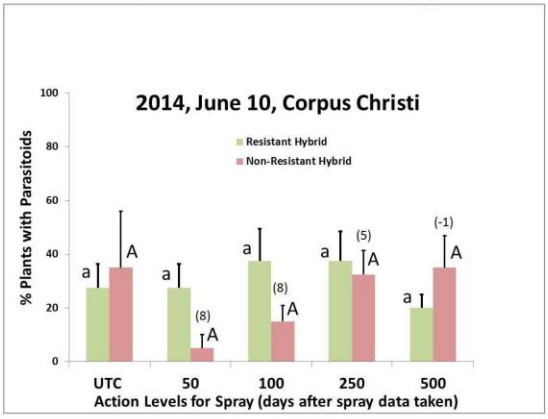
- % plants with aphids did not show effectiveness of spray, as seen with aphids per leaf.

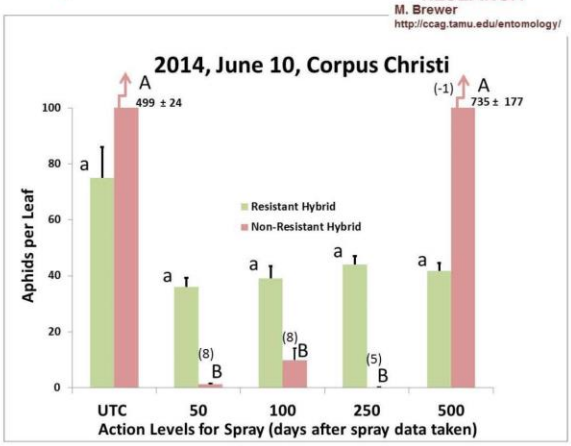


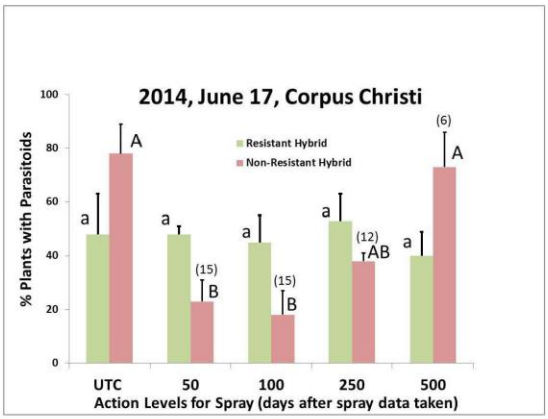
- If % plants with aphids per leaf (or % plants with 10 aphids per leaf) were used as a trigger for insecticide use, sprays would have been triggered at the same time for action levels from 50 to 500 aphids per leaf

Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/



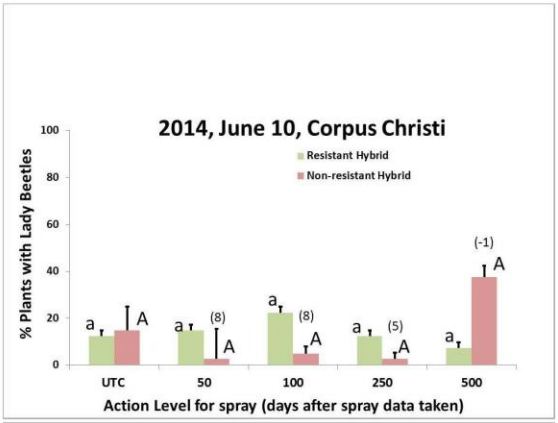


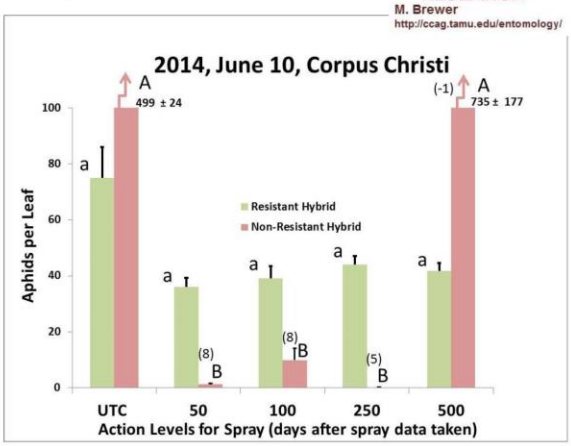


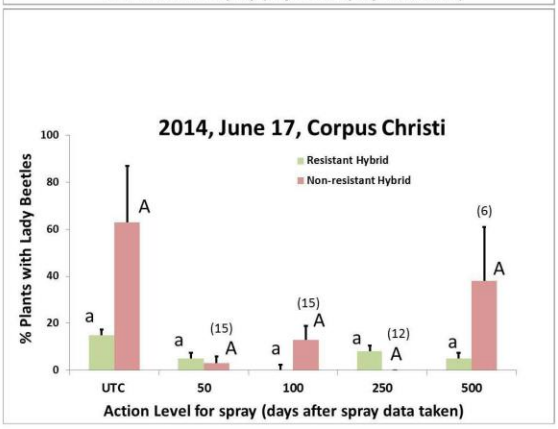
- Parasitism was detected readily in both resistant and non-resistant hybrid, even though the non-resistant hybrid had many more aphids in the UTC
- Spraying resulted in less parasitism at the 50 and 100 aphids per leaf action level.
- Parasitism at the 250 and 500 aphids per leaf action level was similar to the UTC (yield was good at 250 aphid per leaf but sooty mold was high).

Threshold/IPM Tactic Compatibility Study

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/







- Lady beetles were higher in the non-resistant hybrid, where aphids were more common, but occurring late.
- There was no direct evidence of lady beetle decline with spraying, the detections tracking well with the aphid populations.

Summary Sampling and Comparison to thresholds

- This aphid likes many of our grain sorghums, overwintering and wind-aided movement of winged aphids likely determines first infestation
- Divide sampling effort
  - Focus weekly **Fast Detection** on Early detection in many fields
  - Focus twice weekly **Quick Delineation** (aphid estimates) in infested fields, possibly weekly in early infestations
  - Following a three week window of aphid growth is critical
- Compare with thresholds
  - 100 aphids/leaf up to boot stage of development, adjust threshold if application delays are expected
  - Using % infested plants is risky, resulting in possible early sprays

Action = 50 and 100 (S), 2 wk post app.
Few aphids, no injury, no yield loss, natural enemies reduced

Action = 250 (S), 2 wk post app.
Modest aphids, modest sooty mold, no yield loss, abundant enemies

  - Results in agreement with site in northern LA (D. Kerns cooperator)
- Natural enemies are diverse, but abundant only after aphid's peak
- Resistant background sorghums hold promise (we never sprayed)

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://coag.tamu.edu/entomology/

Acknowledgements:

The Fast Detection and Quick Delineation Team

Travis Ahrens
Darwin Anderson
Luke Pruter
James Glover
Robert Bowling
Justin Schmidt

Many thanks to the Rooney lab for their expertise and labor during harvest.

Thanks to Drs. Bill Rooney and Gary Peterson for discussion about sorghum, and providing sorghum seed.

Special thanks to Darwin Anderson and Travis Ahrens for land care, insecticide application, through data management

Acknowledgements: A regional response and thanks

The following individuals are acknowledged for their contributions to the 2013 regional maps.		
Alan Knutson (TX)	Raul Villaneuva (TX)	Clyde Crumley (TX)
Roy Parker (TX)	Gary Odvody (TZX(	David Ragsdale (TX)
Mike Brewer TX)	James Swart (TX)	David Kerns (LA)
Danielle Sekula-Ortiz (TX)	Mo Way (TX)	Scott Armstrong (OK)
Stephen Biles (TX)		

The following individuals are acknowledged for their contributions to the 2013/2014 regional maps.			
Alan Knutson (TX)	Raul Villaneuva (TX)	Scott Stewart (TN)	Angus Catchot (MS)
Charles Allen (TX)	Marty Jungman (TX)	Kathy Flanders (AL)	Gus Lorenz (AR)
Mike Brewer TX)	James Swart (TX)	David Buntin (GA)	David Kerns (LA)
Danielle Sekula-Ortiz (TX)	Mo Way (TX)	Mace Bauer (FL)	Tom Royer (OK)
Stephen Biles (TX)	Pete Flores (TX)	Gregg Nuessly (FL)	Scott Armstrong (OK)
Rick Minzenmayer TX)	Roy Parker (TX)	Sebe Brown (LA)	Jeff Gore (MS)
Kara Matheney (TX)	Gary Odvody (TX)	David Ragsdale (TX)	James Grichar (TX)
Glen Moore (TX)	Clyde Crumley (TX)	Gary Kennedy (TX)	

Financial supporters:

Texas Grain Sorghum Board

USDA NIFA Southern Region IPM and upcoming support

USDA Step-up Undergraduate Training (TAMU Kingsville, Del Mar College)

USDA NIFA Crop Protect & Pest Manage., Applied Res. & Dev.

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

TEXAS A&M UNIVERSITY

Attachment E

An Integrated Regional Response to an Invasive Aphid Pest of Sorghum

An Integrated Regional Response to an Invasive Aphid Pest of Sorghum

Michael Brewer [1 3], David Kerns [4], M.O. Way [1 3], Raul Villanueva [2 3], Stephen Biles [2 3], and James Woolley [1 3]

[1] Texas A&M AgriLife Research

[2] Texas A&M AgriLife Extension

[3] Department of Entomology, Texas A &M University

[4] LSU AgCenter, Department of Entomology, LSU

http://ccag.tamu.edu/sugarcane-aphid/

Many thanks

Travis Ahrens Darwin Anderson Justin Schmidt
Luke Pruter James Glover
Bill Rooney's lab for their expertise and labor during harvest.
Robert Bowling for many contributions.

Financial supporters:

Texas Grain Sorghum Board *USDA NIFA Southern Region IPM*

USDA Step-up Undergraduate Training (TAMU Kingsville, Del Mar College)

USDA NIFA Crop Protect & Pest Manage., Applied Res. & Dev.

Outline

I. Occurrence and Damage

II. Brief on Natural Control, Sorghum Resistance & Insecticides

III. In-season Decision-making

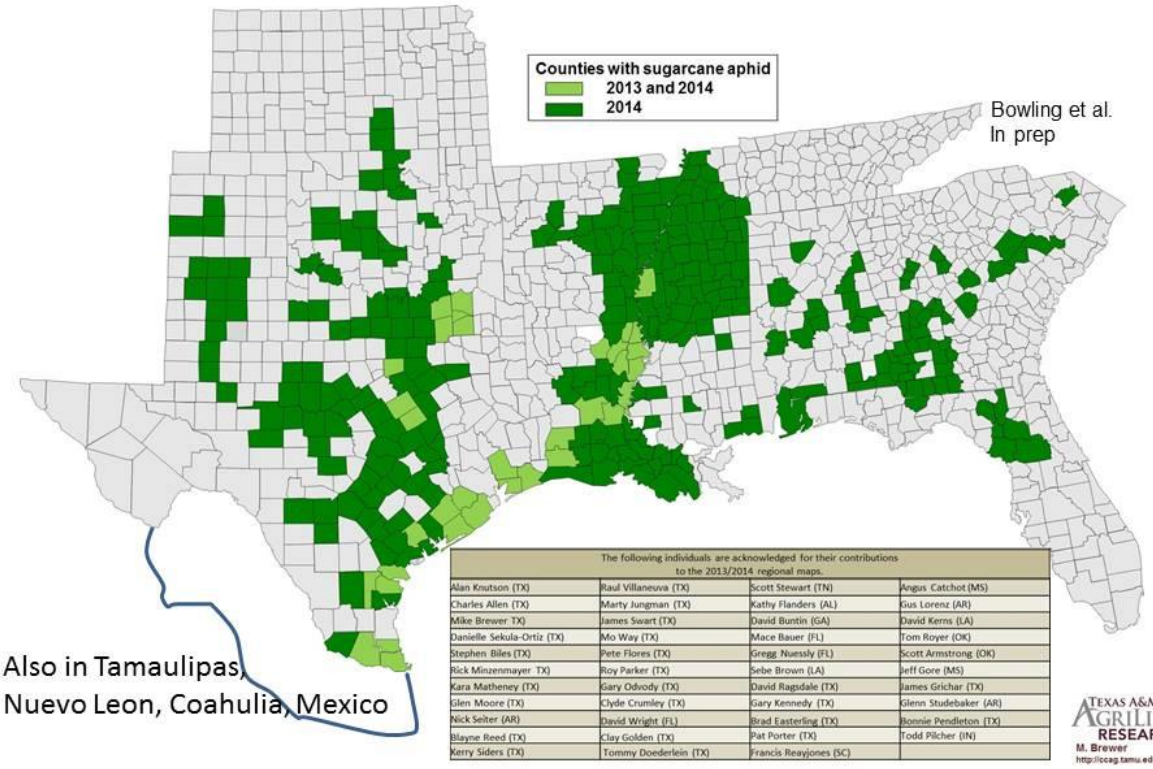
First detection/Monitoring

Economic Injury Level/Thresholds

I. Occurrence and Damage

Sugarcane Aphid Occurrence on Sorghum

2013-2014, some unconfirmed detections in 2012



The following individuals are acknowledged for their contributions to the 2013/2014 regional maps.			
Alan Knutson (TX)	Raul Villanevva (TX)	Scott Stewart (TN)	Angus Catchot (MS)
Charles Allen (TX)	Marty Jungman (TX)	Kathy Flanders (AL)	Gus Lorenz (AR)
Mike Brewer TX)	James Swart (TX)	David Buntin (GA)	David Kerns (LA)
Danielle Sekula-Ortiz (TX)	Mo Way (TX)	Mace Bauer (FL)	Tom Royer (OK)
Stephen Biles (TX)	Pete Flores (TX)	Gregg Nuessly (FL)	Scott Armstrong (OK)
Rick Minzenmayer TX)	Roy Parker (TX)	Sebe Brown (LA)	Jeff Gore (MS)
Kara Matheney (TX)	Gary Odvody (TX)	David Ragsdale (TX)	James Grichar (TX)
Glen Moore (TX)	Clyde Crumley (TX)	Gary Kennedy (TX)	Glenn Studebaker (AR)
Nick Seiter (AR)	David Wright (FL)	Brad Easterling (TX)	Bonnie Pendleton (TX)
Blayne Reed (TX)	Clay Golden (TX)	Pat Porter (TX)	Todd Pilcher (IN)
Kerry Siders (TX)	Tommy Doederlein (TX)	Francis Reayjones (SC)	

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Sorghum Damage and Harvest Problems

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Plant injury caused by general plant decline associated with aphid load
No detection of acute plant toxicity or severe disease association (potovirus suspected)
Many grain sorghums are excellent hosts, 50 to 500 aphid increase seen < 14 days
Yield loss:
- **When aphids infest before head emergence, plant decline-related grain loss + honeydew-related harvest loss**
- **When aphids infest after head emergence, plant decline less likely but abundant honeydew affects harvest**

G. Odvody/M. Brewer, AgriLife Research, T. Ahrens, Del Mar College

3-4 weeks

2 weeks

M. Way/M. Brewer, AgriLife Research

At harvest

R. Villianueva, AgriLife Extension

II. Brief on Natural Control, Sorghum Resistance & Insecticides

Predatory beetles and flies, and parasitoids (black mummies) most active after head emergence and after vegetation-stage control decisions have been made (2014 July, South Texas), **impact potential in future?**

R. Villanueva, AgriLife Extension

M. Brewer, AgriLife Research

T. Ahrens, Del Mar College

R. Villanueva, AgriLife Extension

T. Ahrens, Del Mar College

X Shirley, AgriLife Research

Aphelinus sp. (*varipes* species group)

More specimens please, 90% alcohol to jimwoolley@tamu.edu

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Sorghum germplasm screens

Scott Armstrong (greenhouse, OK, South Texas)
Gary Peterson (field, South Texas)
Bill Rooney (field, South Texas)

Sorghum hybrid screens

David Kerns (greenhouse, Louisiana)
Bonnie Pendleton (greenhouse, Texas High Plains)
Daniel Sekula (field, Rio Grande Valley)
Robert Bowling, Michael Brewer (Texas Gulf Coast)

G. Peterson, AgriLife Research

Adult sorghum plants susceptible (left) and less susceptible (right) to sugarcane aphid

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Insecticide efficacy

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Location: Corpus Christi, sorghum hybrid ATx 2752 x Rtx430 (susceptible)
Planted: April 11, 2014, emerged April 16; 40 ft by 4 rows, data on inner two rows
Aphids/spray : **First aphids at 5/6 leaf stage; flag-leaf spray at 500 aphids/leaf**, **14 GPA**, hollow tips (ConeJet TX-12), RBD: Endigo (5 oz/ac) Transform (0.75 oz/ac), Silvanto (8 oz/ac), Chlorpyrifos (1 pt/ac), Dimethoate (1 pt/ac), UTC
Data: **aphids/leaf 3, 7, and 14 DAT**. % leaves with parasitoids, mold at 7 DAT, yield (bu/ac)

	UTC	Endigo	Transform	Sivanto	Chlor.	Dimet.
Aphids/leaf, 3DAT	456 (124) A	1.2 (0.28) B	4.2 (3.7) B	102 (61) AB	223 (176) AB	177 (139) AB
Aphids/leaf, 7DAT	543 (162) A	0.02 (0.01) B	1.2 (0.71) B	1.9 (0.80) B	298 (283) A	262 (186) A
Aphids/leaf, 14DAT	325 (138) A	0.12 (0.10) B	12.0 (5.3) B	10.2 (5.1) B	344 (311) A	280 (254) A

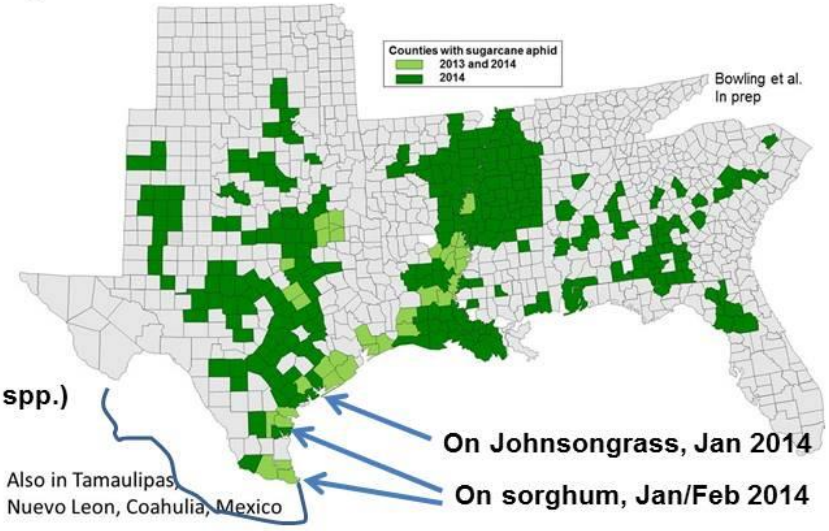
Different letters across rows indicated significant difference at $\alpha = 0.05$, Tukey's test
Endigo (thiamethoxam+lamda-cyhalothrin), Transform (sulfoxaflor), Sivanto (flupyradifurone)
Midge also reduced yields, treatment occurred past threshold, complicating yield comparison

III. In-season Decision-making: First detection/Monitoring Off-crop

Winter survivors and winged aphids during crop emergence:
Inspect remnant sorghum, forage sorghum and Johnsongrass
Winged aphids indication of wind-aided movement to new fields

Detected on sorghum regrowth and green stalk near and in head
Lower Texas Gulf Coast, 2014 Jan/Feb; Nov. 2014
Detected on Johnsongrass along Upper Texas Gulf Coast, Jan 2014
None further north along coast winter 2014
Still on crop Nov 2014 in High Plains

Must exist on green living plant material during fall/winter (*Sorghum* spp.)



TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

First Detection On-crop

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

- Weekly **Fast Detection** sampling

  Inspect plant bottom to top, underside of leaves, **look for honeydew**
  50 foot of row near field edge and at least 25 feet into field,
  check each side of field, and any locations near Johnsongrass

- If colonies and honey dew toward bottom of plant
  Go to **twice weekly Delineation sampling** (density estimation)
- If few new colonies/winged aphid toward top of plant ONLY
  Go to **at least weekly Delineation sampling** (density estimation)
- If no detection, Continue weekly detects

G. Odvody/M. Brewer, AgriLife Research

T. Ahrens, Del Mar College

M. Way/M. Brewer, AgriLife Research

Once Aphids detected On-crop

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

- Before head emergence **Quick Delineation** (density estimate)
  - Use quick aphid/leaf checker, compare against thresholds (veg stage)
  - If above threshold, spray within three days
  - If below threshold on many leaves, need inspection twice per week
  - If below threshold with only new colonies/winged aphids top of plant, new infestation to monitor, advise twice per week
- When head emerged and expanding colonies moving onto stalk/head estimate density, consider head protection spray (?)

G. Odvody/M. Brewer, AgriLife Research

T. Ahrens, Del Mar College

Quick Aphid/leaf ck (20-40 leaves per spot, half top, half bottom)

0-10: actual count
A: 11-25 aphids (18)
B: 26-50 aphids (38)
C: 51-100 aphids (75)
D: 101-500 aphids (300)
E: 501-1,000 aphids (750)
F: > 1,000 aphids (1,500)

III. In-season Decision-making: Economic Injury Level/Thresholds

Threshold/IPM Tactic Compatibility Study

Locations: Corpus Christi, TX (duplicate in Winnsboro, LA)
Planted: April 11, 2014, emerged April 16; 40 ft by 4 rows, data on inner two rows
Aphids: **First arrivals at 5 to 6 leaf stage of plant development**
RCB of two factors: action thresholds and hybrid background
Action thresholds for foliar insecticide: 50, 100, 250 &500 aphids/leaf and UTC
Transform (sulfoxaflor) 0.75 oz per acre, 14 GPA, hollow tips (ConeJet TX-12)
Oversprayed all plots at soft dough to control midge and worms
Hybrids: Susceptible sorghum (S, ATX2752 x RTX430) and a
(greenbug) resistance sorghum (R, ATX2752 x RTX2783)

Measurements: **Data taken weekly**
Aphid density (aphid/leaf)
20 leaves per plot, 10 top, 10 bottom
Percent of **leaves with sooty mold** (mold)
Percent of **leaves with mummies** (parasitoids)
Percent of **leaves with lady beetle** adults or larvae
Yield (bushels/acre), 100 foot-row

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Threshold/IPM Tactic Compatibility Study

Results in Pictures

Action =UTC (S)
High aphids 7-14DAT,
and damage visible
bottom half of plant

T. Ahrens,
Del Mar College

Action = 50 and 100 (S)
Few aphids 7-14 DAT, no injury,
no yield loss,
natural enemies reduced

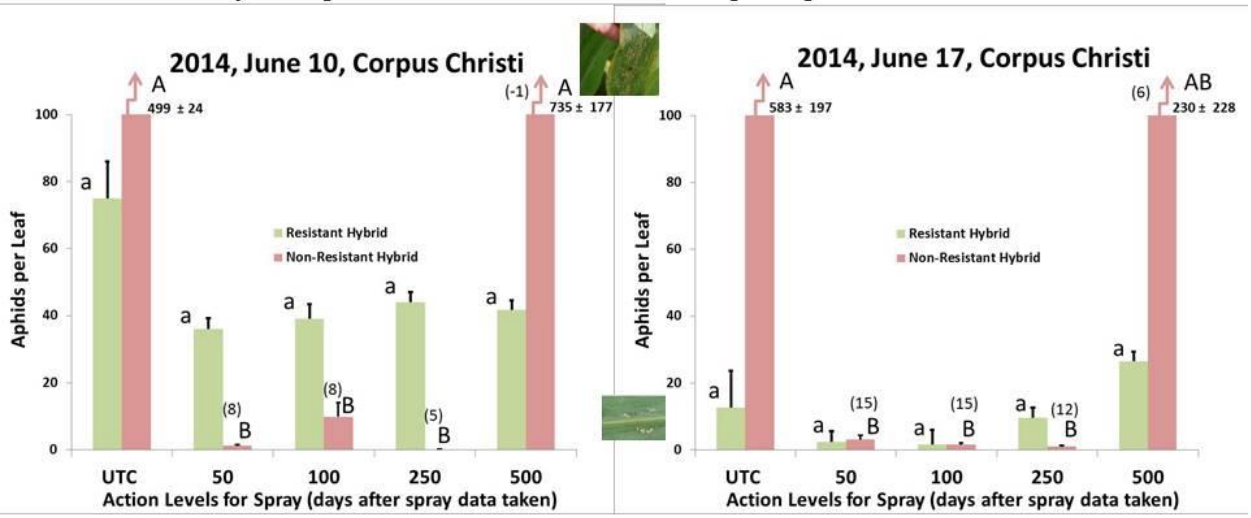
Action = 50 to 500 (R, Tx2783) Rarely sprayed

Action = 250 (S)
Few aphids 7-14 DAT,
sooty mold readily detected,
no yield loss,
abundant enemies

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Aphids

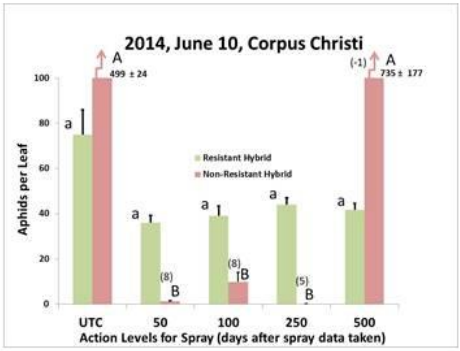
- Sprayed one time (Corpus Christi) and 1-2 time (Winnsboro, LA)
- **Action levels of 50 to 250 aphids/leaf resulted in consistently low aphids for 2 weeks on the non-resistant hybrid (pink bars)**
- Spraying 500 aphids/leaf resulted in poor aphid suppression
- Unsprayed plots resulted in aphids as high as 1,050 aphids/leaf after 3 weeks (not shown)
- The resistant hybrid aphid counts never exceeded 50 aphids per leaf

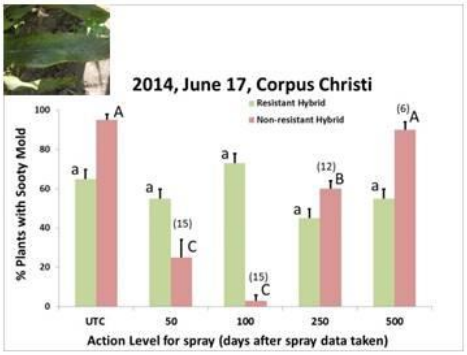


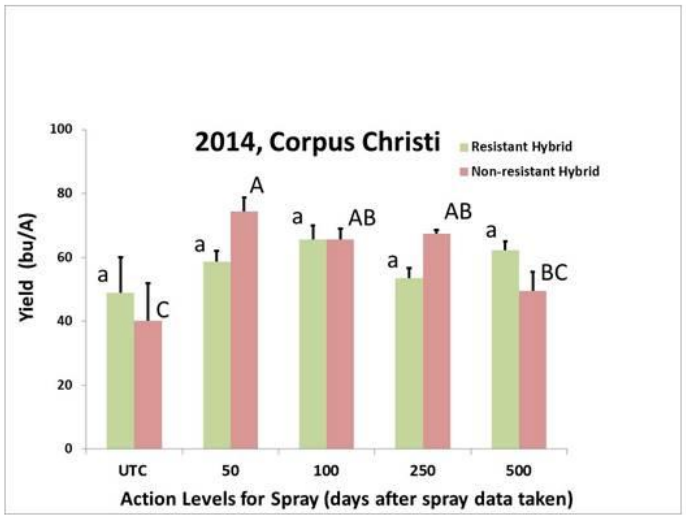
Notes: Plants were at V6 to flag leaf on June 10, and boot to 1/3 bloom on June 17.
Action level triggered Transform (sulfoxaflor) application at the same time for the 50 and 100 aphids per leaf action level on the non-resistant hybrid, three days later for the 250 aphids per leaf action level, and six days later for the 500 aphids per leaf action level.

Aphids and Yield

TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

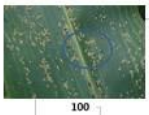


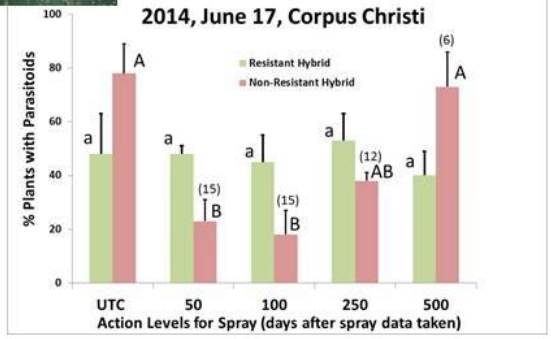


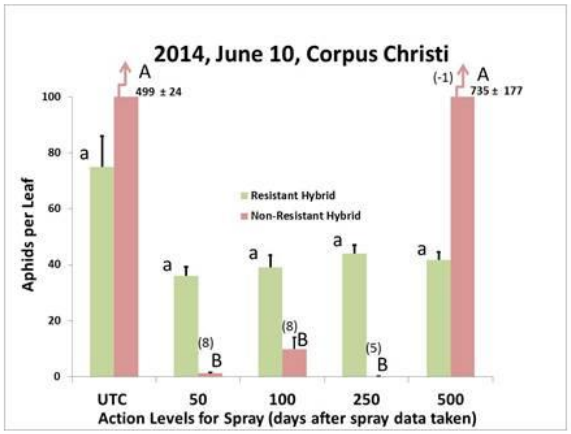


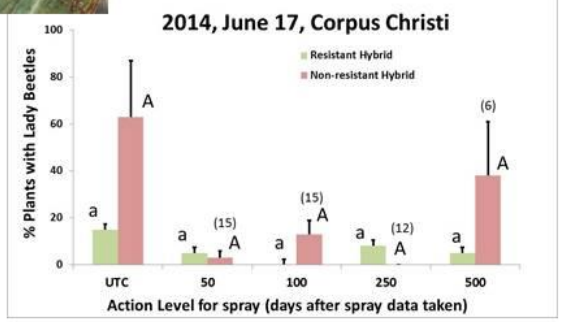
- **Action levels of 50 to 250 aphids per leaf resulted in the highest yield of the non-resistant hybrid, but sooty mold was high at 250 aphids/leaf**
- The resistant hybrid was never sprayed and had yields comparable to the non-resistant sprayed hybrid

Aphids and natural enemies







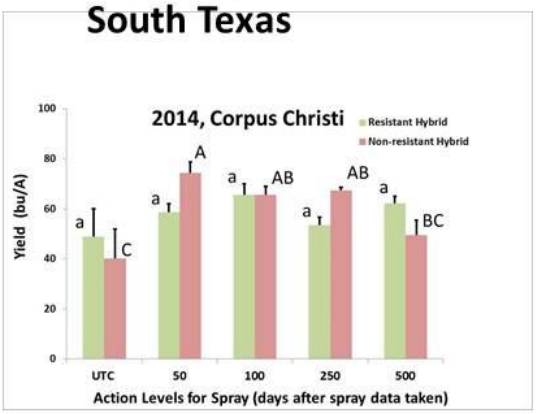


- **Parasitoids common, reduced at 50/100 action thresholds**
- Lady beetles tracked aphids, not common on resistant hybrid

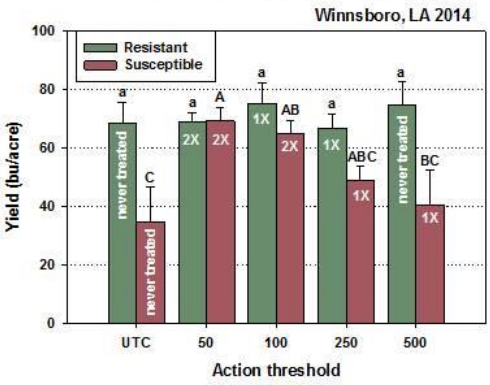
TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

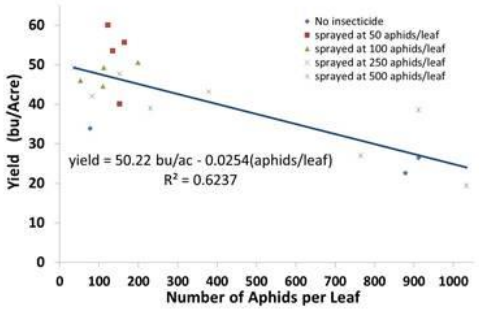
Yield—Aphid (peak count) Regression → Economic Injury Level

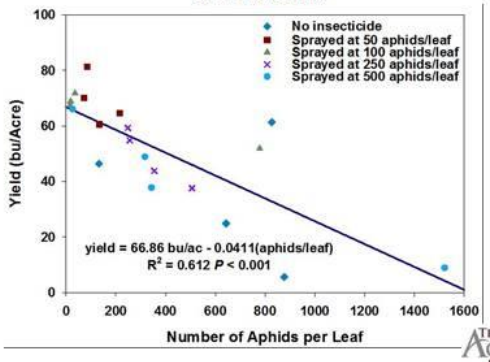
South Texas



Northern Lousiana







TEXAS A&M AGRILIFE RESEARCH
M. Brewer
http://ccag.tamu.edu/entomology/

Loss estimates per 100 aphids/leaf:

South TX: 2.54 bu/ac Northern LA: 4.11 bu/ac Ave: 3.325 bu/ac

Economic Injury level (aphids/leaf), ET = EIL reduced by 30%

TEXAS A&M AGRILIFE RESEARCH M. Brewer http://ccag.tamu.edu/entomology/

Sweet spot given current economics, aphid growth, natural enemies

Infestations before head emergence STX, South Texas NLA, North Louisiana

		Control cost $10/acre Aphids/leaf			Control cost $15/acre Aphids/leaf			Control cost $20/acre Aphids/leaf			Control cost $25/acre Aphids/leaf		
Market value		Site	EIL	ET	Site	EIL	ET	Site	EIL	ET	Site	EIL	ET
$3.50 / bu		STX	118	83	STX	178	125	STX	237	166	STX	296	207
		NLA	73	51	NLA	110	77	NLA	146	102	NLA	183	128
		Region	90	63	Region	136	95	Region	181	127	Region	226	158
$5.00 / bu		STX	83	58	STX	124	87	STX	166	116	STX	207	145
		NLA	51	36	NLA	77	54	NLA	102	71	NLA	128	90
		Region	63	44	Region	95	66	Region	127	89	Region	158	111
$6.50 / bu		STX	64	45	STX	96	67	STX	128	90	STX	159	111
		NLA	39	27	NLA	59	41	NLA	79	55	NLA	99	69
		Region	49	34	Region	73	51	Region	97	68	Region	122	85

From Pedigo's method $EIL = C/(V*I*D*K)$

K set at 0.95 as the proportion of the insect population controlled (taken from efficacy studies)

$I*D$ is loss estimate estimated from the slope of yield—aphid/leaf regression

Range from 0.0254 [South Texas] to 0.0411 [northern Louisiana] bu/ac per aphid/leaf .

Set Economic threshold 30% lower than EIL, given the aphid population growth and delay in control but also consider natural enemy preservation (don't go too low):

Regional ET (most current conditions) 50--125 aphids per leaf

Summary

- This aphid likes many of our grain sorghums and survives on other *Sorghum* spp., overwintering and wind-aided movement of winged aphids likely determines first infestation
- Natural enemies are abundant but after heads appear. Impact studies needed
- Resistant background sorghums hold promise
- Divide sampling effort
  - Focus weekly **Fast Detection** for first detection in many fields
  - Focus twice weekly **Quick Delineation** (aphid estimates) in infested fields
  - Following a three week window of rapid aphid growth is critical
- Compare with thresholds for in-season decision-making
  - **Regional ET of 50—125 aphids/leaf pre-head emergence under most current economics, aphid growth & natural enemies**
  - Future refinements (?): aphid growth, natural enemy impact, % infested plants, more locations

http://ccag.tamu.edu/sugarcane-aphid/

TEXAS A&M AGRILIFE RESEARCH | TEXAS A&M AGRILIFE EXTENSION | LSU AgCenter Research & Extension

TEXAS A&M AGRILIFE RESEARCH M. Brewer http://ccag.tamu.edu/entomology/

Attachment F

Endangered and Threatened Species List 2011

USFWS Species Status Codes

A series of codes has been developed to identify the current status of each listed species in our endangered species database. See below for descriptions of some of the more commonly used codes.

E = endangered. A species "in danger of extinction throughout all or a significant portion of its range."

T = threatened. A species "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

C = candidate. A species under consideration for official listing for which there is sufficient information to support listing.

SAE, E(S/A) = endangered due to similarity of appearance. A species that is endangered due to similarity of appearance with another listed species and is listed for its protection. Species listed as E(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

SAT, T(S/A) = threatened due to similarity of appearance. A species that is threatened due to similarity of appearance with another listed species and is listed for its protection. Species listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

EXPE, XE = experimental essential population. A species listed as experimental and essential. EXPN, XN = experimental non-essential population. A species listed as experimental and non-essential. Experimental, nonessential populations of endangered species (e.g., red wolf) are treated as threatened species on public land, for consultation purposes, and as species proposed for listing on private land.

PE = proposed endangered. Species proposed for official listing as endangered.

PT = proposed threatened. Species proposed for official listing as threatened.

PEXPE, PXE = proposed experimental population, essential. Species proposed for official listing as experimental and essential.

PEXPN, PXN = proposed experimental population, non-essential. Species proposed for official listing as experimental and non-essential.

PSAE, PE (S/A) = proposed endangered, due to similarity of appearance. Species proposed for official listing as endangered due to similarity of appearance with another listed species.

PSAT, PT (S/A) = proposed threatened, due to similarity of appearance. Species proposed for official listing as threatened due to similarity of appearance with another listed species.

Emergency Endangered - A temporary (240 days) listing for emergency purposes when species is at significant, immediate risk.

Delisted - Species that has been removed from the list due to recovery, original data in error, or extinction.

Species of Concern (SC) - Species that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

Resolved Taxon (RT) - Species that have been petitioned for listing and for which a Not Warranted 12 month finding or Not Substantial 90-day finding has been published in the Federal Register. Also includes species that have been removed from the candidate list.

Under Review (UR) - Species that have been petitioned for listing and for which a 90-day finding has not been published or for which a 90-day substantial has been published but a 12 Month finding have not yet been published in the Federal Register. Also includes species that are being reviewed through the candidate process, but the CNOR has not yet been signed.

Format for each county
Common Name Scientific Name Species Type Status (see key above)

Anderson County
No Common Name *Geocarpon minimum* Flowering Plants T

Andrews County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Northern aplomado falcon *Falco femoralis septentrionalis* Birds E
Sand dune Lizard *Sceloporus arenicolus* Reptiles C

Angelina County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Red-cockaded woodpecker *Picoides borealis* Birds E

Aransas County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Mountain plover *Charadrius montanus* Birds PT
Northern aplomado falcon *Falco femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T Final P
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Archer County
Whooping crane *Grus americana*Birds E, EXPN

Armstrong County
Whooping crane *Grus americana*Birds E, EXPN

Atascosa County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Austin County
Houston toad *Bufo houstonensis* Amphibians E
Whooping crane *Grus americana*Birds E, EXPN

Bailey County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Bandera County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

Bastrop County
Houston toad *Bufo houstonensis* Amphibians E Final P
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Baylor County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Bee County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Bell County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Salado Salamander Eurycea chisholmensis Amphibians C
Whooping crane *Grus americana*Birds E, EXPN

Bexar County
[unnamed] ground beetle Rhadine exilis Insects E Final P
[unnamed] ground beetle Rhadine infernalis Insects E Final P
Black-capped Vireo *Vireo atricapilla* Birds E
Braken Bat Cave Meshweaver Cicurina venii Arachnids E
Cokendolpher Cave Harvestman Texella cokendolpheri Arachnids E
Comal Springs dryopid beetle *Stygoparnus comalensis* Insects E
Comal Springs riffle beetle *Heterelmis comalensis* Insects E
Fountain darter *Etheostoma fonticola* Fishes E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Government Canyon Bat Cave Meshweaver Cicurina vespera Arachnids E
Government Canyon Bat Cave Spider Neoleptoneta microps Arachnids E
Helotes mold beetle Batrisodes venyivi Insects E
Madla's Cave Meshweaver Cicurina madla Arachnids E Final P
Mountain plover *Charadrius montanus* Birds PT
Peck's cave amphipod *Stygobromus* (=Stygonectes) *pecki* Crustaceans E

Robber Baron Cave Meshweaver Cicurina baronia Arachnids E
San Marcos salamander *Eurycea nana* Amphibians T
Texas blind salamander *Typhlomolge rathbuni* Amphibians E
Texas wild-rice *Zizania texan*a Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Blanco County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Bosque County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Bowie County
Least tern *Sterna antillarum* Birds E

Brazoria County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Piping Plover *Charadrius melodus* Birds E, T Final P
Whooping crane *Grus americana*Birds E, EXPN

Brazos County
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Brewster County
Big Bend gambusia Gambusia gaigei Fishes E
Black-capped Vireo *Vireo atricapilla* Birds E
Bunched cory cactus Coryphantha ramillosa Flowering Plants T
Chisos Mountain hedgehog Cactus Echinocereus chisoensis var. chisoensis Flowering Plants T
Davis' green pitaya Echinocereus viridiflorus var. davisii Flowering Plants E
Guadalupe fescue Festuca ligulata Flowering Plants C
Hinckley oak Quercus hinckleyi Flowering Plants T
Lloyd's Mariposa cactus Echinomastus mariposensis Flowering Plants T
Mexican long-nosed bat Leptonycteris nivalis Mammals E
Mexican spotted owl *Strix occidentalis lucida* Birds T
Mountain plover *Charadrius montanus* Birds PT
Nellie cory cactus Coryphantha minima Flowering Plants E

Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Rio Grande silvery minnow *Hybognathus amarus* Fishes E
Southwestern willow flycatcher *Empidonax traillii extimus* Birds E
Terlingua Creek cat's-eye Cryptantha crassipes Flowering Plants E
Texas hornshell (mussell) Popenaias popei Clams C
Yellow-billed Cuckoo *Coccyzus americanus* Birds C

Briscoe County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Brooks County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

Brown County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Burleson County
Houston toad *Bufo houstonensis* Amphibians E Final P
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Burnet County
Bee Creek Cave harvestman *Texella reddelli* Arachnids E
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Caldwell County
Whooping crane *Grus americana*Birds E, EXPN

Calhoun County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Piping Plover *Charadrius melodus* Birds E, T Final P
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Callahan County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Cameron County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Mountain plover *Charadrius montanus* Birds PT
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T Final P
South Texas ambrosia *Ambrosia cheiranthifolia* Flowering Plants E
Texas ayenia *Ayenia limitaris* Flowering Plants E
West Indian Manatee *Trichechus manatus* Mammals E

Carson County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Castro County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Chambers County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Piping Plover *Charadrius melodus* Birds E, T

Cherokee County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Neches River rose-mallow *Hibiscus dasycalyx* Flowering Plants C
Red-cockaded woodpecker *Picoides borealis* Birds E

Childress County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Clay County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Cochran County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Sand dune Lizard *Sceloporus arenicolus* Reptiles C
Whooping crane *Grus americana*Birds E, EXPN

Coke County
Black-capped Vireo *Vireo atricapilla* Birds E
Texas poppy-mallow *Callirhoe scabriuscula* Flowering Plants E

Coleman County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Collin County
Whooping crane *Grus americana*Birds E, EXPN
Collingsworth County
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Colorado County
Houston toad *Bufo houstonensis* Amphibians E
Mountain plover *Charadrius montanus* Birds PT
Whooping crane *Grus americana*Birds E, EXPN

Comal County
Black-capped Vireo *Vireo atricapilla* Birds E
Comal Springs dryopid beetle *Stygoparnus comalensis* Insects E Final P
Comal Springs riffle beetle *Heterelmis comalensis* Insects E Final P
Fountain darter *Etheostoma fonticola* Fishes E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Peck's cave amphipod *Stygobromus* (=Stygonectes) *pecki* Crustaceans E Final P
San Marcos salamander *Eurycea nana* Amphibians T
Texas blind salamander *Typhlomolge rathbuni* Amphibians E
Texas wild-rice *Zizania texan*a Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Comanche County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Concho County
Black-capped Vireo *Vireo atricapilla* Birds E
Mountain plover *Charadrius montanus* Birds PT

Cooke County
Black-capped Vireo *Vireo atricapilla* Birds E
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Coryell County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Cottle County
Whooping crane *Grus americana*Birds E, EXPN

Crane County
Sand dune Lizard *Sceloporus arenicolus* Reptiles C

Crockett County
Black-capped Vireo *Vireo atricapilla* Birds E

Crosby County
Whooping crane *Grus americana*Birds E, EXPN

Culberson County
Guadalupe fescue Festuca ligulata Flowering Plants C
Mexican spotted owl *Strix occidentalis lucida* Birds T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Southwestern willow flycatcher *Empidonax traillii extimus* Birds E
Yellow-billed Cuckoo *Coccyzus americanus* Birds C

Dallas County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Least tern *Sterna antillarum* Birds E
Piping Plover *Charadrius melodus* Birds E, T
Whooping crane *Grus americana*Birds E, EXPN

Dawson County
Whooping crane *Grus americana*Birds E, EXPN

Deaf Smith County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Delta County
Least tern *Sterna antillarum* Birds E
Piping Plover *Charadrius melodus* Birds E, T

Denton County
Least tern *Sterna antillarum* Birds E
Piping Plover *Charadrius melodus* Birds E, T
Whooping crane *Grus americana*Birds E, EXPN

DeWitt County
Whooping crane *Grus americana*Birds E, EXPN

Dickens County
Whooping crane *Grus americana*Birds E, EXPN

Dimmitt County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

Donley County
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Duval County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Walker's manioc *Manihot walkerae* Flowering Plants E

Eastland County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Ector County
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E

Edwards County
Black-capped Vireo *Vireo atricapilla* Birds E
golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Texas snowbells Styrax texanus Flowering Plants E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

El Paso County
least tern *Sterna antillarum* Birds E
Mexican spotted owl *Strix occidentalis lucida* Birds T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Sneed pincushion cactus *Coryphantha sneedii var. sneedii* Flowering Plants E
Southwestern willow flycatcher *Empidonax traillii extimus* Birds E
Yellow-billed Cuckoo *Coccyzus americanus* Birds C

Ellis County
Whooping crane *Grus americana*Birds E, EXPN

Erath County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Falls County
Whooping crane *Grus americana*Birds E, EXPN

Fannin County
Least tern *Sterna antillarum* Birds E

Fayette County
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Fisher County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C

Floyd County
Whooping crane *Grus americana*Birds E, EXPN

Foard County
Whooping crane *Grus americana*Birds E, EXPN

Fort Bend County
Texas prairie dawn-flower *Hymenoxys texana* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Freestone County
Large-fruited sand-verbena *Abronia macrocarpa* Flowering Plants E
Least tern *Sterna antillarum* Birds E
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Frio County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

Gaines County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Sand dune Lizard *Sceloporus arenicolus* Reptiles C

Galveston County
Brown pelican *Pelecanus occidentalis* Birds DM
Eskimo curlew Numenius borealis Birds E
Green sea turtle *Chelonia mydas* Reptiles E, T
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Piping Plover *Charadrius melodus* Birds E, T Final P

Garza County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Gillespie County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Goliad County
Whooping crane *Grus americana*Birds E, EXPN

Gonzales County
Whooping crane *Grus americana*Birds E, EXPN

Gray County
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Grayson County
Least tern *Sterna antillarum* Birds E
Piping Plover *Charadrius melodus* Birds E, T
Whooping crane *Grus americana*Birds E, EXPN

Gregg County
Least tern *Sterna antillarum* Birds E

Grimes County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Guadalupe County
Mountain plover *Charadrius montanus* Birds PT
Whooping crane *Grus americana*Birds E, EXPN

Hale County
Whooping crane *Grus americana*Birds E, EXPN

Hall County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Hamilton County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Hardeman County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Hardin County
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas trailing phlox *Phlox nivalis ssp. texensis* Flowering Plants E

Harris County
Texas prairie dawn-flower *Hymenoxys texana* Flowering Plants E

Harrison County
No Common Name *Geocarpon minimum* Flowering Plants T

Haskell County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Hays County
Austin blind Salamander *Eurycea waterlooensis* Amphibians C
Barton Springs salamander *Eurycea sosorum* Amphibians E
Black-capped Vireo *Vireo atricapilla* Birds E
Comal Springs dryopid beetle *Stygoparnus comalensis* Insects E Final P

Comal Springs riffle beetle *Heterelmis comalensis* Insects E
Fountain darter *Etheostoma fonticola* Fishes E Final P
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Peck's cave amphipod *Stygobromus* (=Stygonectes) *pecki* Crustaceans E
San Marcos gambusia *Gambusia georgei* Fishes E Final P
San Marcos salamander *Eurycea nana* Amphibians T Final P
Texas blind salamander *Typhlomolge rathbuni* Amphibians E
Texas wild-rice *Zizania texan*a Flowering Plants E Final P
Whooping crane *Grus americana*Birds E, EXPN

Hemphill County
Arkansas River shiner *Notropis girardi* Fishes T
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Henderson County
Whooping crane *Grus americana*Birds E, EXPN

Hidalgo County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Mountain plover *Charadrius montanus* Birds PT
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Star cactus *Astrophytum asterias* Flowering Plants E
Texas ayenia *Ayenia limitaris* Flowering Plants E
Walker's manioc *Manihot walkerae* Flowering Plants E

Hill County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Hockley County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Hood County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Hopkins County
Least tern *Sterna antillarum* Birds E

Houston County
Neches River rose-mallow *Hibiscus dasycalyx* Flowering Plants C
Red-cockaded woodpecker *Picoides borealis* Birds E

Hudspeth County
Mexican spotted owl *Strix occidentalis lucida* Birds T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Southwestern willow flycatcher *Empidonax traillii extimus* Birds E
Yellow-billed Cuckoo *Coccyzus americanus* Birds C

Hutchinson County
Arkansas River shiner *Notropis girardi* Fishes T
Least tern *Sterna antillarum* Birds E

Irion County
Black-capped Vireo *Vireo atricapilla* Birds E

Jack County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus Americana* Birds E, EXPN

Jackson County
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus Americana* Birds E, EXPN

Jasper County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Red-cockaded woodpecker *Picoides borealis* Birds E

Jeff Davis County
Black-capped Vireo *Vireo atricapilla* Birds E
Comanche Springs pupfish *Cyprinodon elegans* Fishes E
Diminutive amphipod Gammarus hyalleloides Crustaceans C
Least tern *Sterna antillarum* Birds E
Little Aguja (=Creek) *Pondweed Potamogeton clystocarpus* Flowering Plants E
Mexican spotted owl *Strix occidentalis lucida* Birds T
Mountain plover *Charadrius montanus* Birds PT
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Pecos gambusia *Gambusia nobilis* Fishes E
Phantom Lake cave Snail *Cochliopa texana* Snails C
Phantom Springsnail (=Tryonia) *Tryonia cheatumi* Snails C
Southwestern willow flycatcher *Empidonax traillii extimus* Birds E
Yellow-billed Cuckoo *Coccyzus americanus* Birds C

Jefferson County
Green sea turtle *Chelonia mydas* Reptiles E, T
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Piping Plover *Charadrius melodus* Birds E, T

Jim Hogg County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

Jim Wells County
Black lace cactus *Echinocereus reichenbachii var. albertii* Flowering Plants E
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
South Texas ambrosia *Ambrosia cheiranthifolia* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Johnson County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Jones County
Whooping crane *Grus americana*Birds E, EXPN

Karnes County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Kaufman County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Kendall County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Kenedy County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E

Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T Final P
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Kent County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Kerr County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

Kimble County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

King County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Kinney County
Black-capped Vireo *Vireo atricapilla* Birds E
Comal Springs dryopid beetle *Stygoparnus comalensis* Insects E
Comal Springs riffle beetle *Heterelmis comalensis* Insects E
Devils River minnow *Dionda diaboli* Fishes T Final P
Fountain darter *Etheostoma fonticola* Fishes E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Peck's cave amphipod *Stygobromus* (=Stygonectes) *pecki* Crustaceans E
San Marcos salamander *Eurycea nana* Amphibians T
Texas blind salamander *Typhlomolge rathbuni* Amphibians E
Texas wild-rice *Zizania texan*a Flowering Plants E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

Kleberg County
Black lace cactus *Echinocereus reichenbachii var. alberti*i Flowering Plants E
Brown pelican *Pelecanus occidentalis* Birds DM

Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Mountain plover *Charadrius montanus* Birds PT
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T Final P
Slender rush-pea *Hoffmannseggia tenella* Flowering Plants E
South Texas ambrosia *Ambrosia cheiranthifolia* Flowering Plants E
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Knox County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

La Salle County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

Lamar County
American burying beetle *Nicrophorus americanus* Insects E
Least tern *Sterna antillarum* Birds E

Lamb County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Lampasas County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Lavaca County
Houston toad *Bufo houstonensis* Amphibians E
Whooping crane *Grus americana*Birds E, EXPN

Lee County
Houston toad *Bufo houstonensis* Amphibians E
Whooping crane *Grus americana*Birds E, EXPN

Leon County
Houston toad *Bufo houstonensis* Amphibians E
Large-fruited sand-verbena *Abronia macrocarpa* Flowering Plants E
Least tern *Sterna antillarum* Birds E
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Liberty County
Red-cockaded woodpecker *Picoides borealis* Birds E

Limestone County
Least tern *Sterna antillarum* Birds E
Mountain plover *Charadrius montanus* Birds PT
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Lipscomb County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Live Oak County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Llano County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Loving County
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E

Lubbock County
Whooping crane *Grus americana*Birds E, EXPN

Lynn County
Whooping crane *Grus americana*Birds E, EXPN

Madison County
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Martin County
Whooping crane *Grus americana*Birds E, EXPN

Mason County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Matagorda County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Piping Plover *Charadrius melodus* Birds E, T Final P
Whooping crane *Grus americana*Birds E, EXPN

Maverick County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

McCulloch County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

McLennan County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

McMullen County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E

Medina County
Black-capped Vireo *Vireo atricapilla* Birds E
Comal Springs dryopid beetle *Stygoparnus comalensis* Insects E
Comal Springs riffle beetle *Heterelmis comalensis* Insects E
Fountain darter *Etheostoma fonticola* Fishes E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Peck's cave amphipod *Stygobromus* (=Stygonectes) *pecki* Crustaceans E
San Marcos salamander *Eurycea nana* Amphibians T
Texas blind salamander *Typhlomolge rathbuni* Amphibians E
Texas wild-rice *Zizania texan*a Flowering Plants E

Menard County
Black-capped Vireo *Vireo atricapilla* Birds E
Clear Creek gambusia *Gambusia heterochir* Fishes E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E

Midland County
Black-capped Vireo *Vireo atricapilla* Birds E

Milam County
Houston toad *Bufo houstonensis* Amphibians E
Least tern *Sterna antillarum* Birds E
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Mills County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Mitchell County
Texas poppy-mallow *Callirhoe scabriuscula* Flowering Plants E

Montague County
Black-capped Vireo *Vireo atricapilla* Birds E
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Montgomery County
Red-cockaded woodpecker *Picoides borealis* Birds E

Moore County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C

Motley County
Whooping crane *Grus americana*Birds E, EXPN

Nacogdoches County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas golden Gladecress *Leavenworthia texana* Flowering Plants C

Navarro County
Whooping crane *Grus americana*Birds E, EXPN

Newton County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Red-cockaded woodpecker *Picoides borealis* Birds E

Nolan County
Black-capped Vireo *Vireo atricapilla* Birds E

Nueces County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T Final P
Slender rush-pea *Hoffmannseggia tenella* Flowering Plants E
South Texas ambrosia *Ambrosia cheiranthifolia* Flowering Plants E
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Ochiltree County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C

Oldham County
Arkansas River shiner *Notropis girardi* Fishes T
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Palo Pinto County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Panola County
No Common Name *Geocarpon minimum* Flowering Plants T

Parker County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Parmer County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Pecos County
Black-capped Vireo *Vireo atricapilla* Birds E

Diamond Y Spring snail *Pseudotryonia (=Tryonia) adamantina* Snails C
Gonzales springsnail Tryonia circumstriata(=stocktonensis) Snails C
Leon Springs pupfish *Cyprinodon bovinus* Fishes E Final P
Mexican spotted owl *Strix occidentalis lucida* Birds T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Pecos(=puzzle,=paradox) sunflower *Helianthus paradoxus* Flowering Plants T Final P
Pecos assiminea snail *Assiminea pecos* Snails E Final P
Pecos gambusia *Gambusia nobilis* Fishes E

Polk County
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas trailing phlox *Phlox nivalis ssp. texensis* Flowering Plants E

Potter County
Arkansas River shiner *Notropis girardi* Fishes T
Whooping crane *Grus Americana* Birds E, EXPN

Presidio County
Hinckley oak *Quercus hinckleyi* Flowering Plants T
Lloyd's Mariposa cactus *Echinomastus mariposensis* Flowering Plants T
Mexican long-nosed bat *Leptonycteris nivalis* Mammals E
Mexican spotted owl *Strix occidentalis lucida* Birds T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Rio Grande silvery minnow *Hybognathus amarus* Fishes E
Southwestern willow flycatcher *Empidonax traillii extimus* Birds E
Yellow-billed Cuckoo *Coccyzus americanus* Birds C

Rains County
Least tern *Sterna antillarum* Birds E

Randall County
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Reagan County
Black-capped Vireo *Vireo atricapilla* Birds E

Real County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Texas snowbells *Styrax texanus* Flowering Plants E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

Red River County
American burying beetle *Nicrophorus americanus* Insects E

Least tern *Sterna antillarum* Birds E

Reeves County
Comanche Springs pupfish *Cyprinodon elegans* Fishes E
Diminutive amphipod Gammarus hyalleloides Crustaceans C
Mexican spotted owl *Strix occidentalis lucida* Birds T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Pecos (=puzzle, =paradox) sunflower *Helianthus paradoxus* Flowering Plants T
Pecos assiminea snail *Assiminea pecos* Snails E Final P
Pecos gambusia *Gambusia nobilis* Fishes E
Phantom Lake cave Snail *Cochliopa texana* Snails C
Phantom Springsnail (=Tryonia) *Tryonia cheatumi* Snails C

Refugio County
Black lace cactus *Echinocereus reichenbachii var. alberti*i Flowering Plants E
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Mountain plover *Charadrius montanus* Birds PT
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

Roberts County
Arkansas River shiner *Notropis girardi* Fishes T
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C

Robertson County
Houston toad *Bufo houstonensis* Amphibians E
Large-fruited sand-verbena *Abronia macrocarpa* Flowering Plants E
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Rockwall County
Whooping crane *Grus americana*Birds E, EXPN

Runnels County
Black-capped Vireo *Vireo atricapilla* Birds E
Texas poppy-mallow *Callirhoe scabriuscula* Flowering Plants E

Sabine County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas golden Gladecress *Leavenworthia texana* Flowering Plants C

San Augustine County
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas golden Gladecress *Leavenworthia texana* Flowering Plants C
White bladderpod Lesquerella pallida Flowering Plants E

San Jacinto County
Red-cockaded woodpecker *Picoides borealis* Birds E

San Patricio County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T Final P
West Indian Manatee *Trichechus manatus* Mammals E
Whooping crane *Grus americana*Birds E, EXPN

San Saba County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Schleicher County
Black-capped Vireo *Vireo atricapilla* Birds E

Shackelford County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Shelby County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Red-cockaded woodpecker *Picoides borealis* Birds E

Somervell County
Black-capped Vireo *Vireo atricapilla* Birds E

Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Starr County
Ashy dogweed *Thymophylla tephroleuca* Flowering Plants E
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Johnston's frankenia *Frankenia johnstonii* Flowering Plants AD, E
Least tern *Sterna antillarum* Birds E
Mountain plover *Charadrius montanus* Birds PT
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Star cactus *Astrophytum asterias* Flowering Plants E
Walker's manioc *Manihot walkerae* Flowering Plants E
Zapata bladderpod *Lesquerella thamnophila* Flowering Plants E Final P
Stephens County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Sterling County
Black-capped Vireo *Vireo atricapilla* Birds E

Stonewall County
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Sutton County
Black-capped Vireo *Vireo atricapilla* Birds E

Swisher County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Tarrant County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Taylor County
Black-capped Vireo *Vireo atricapilla* Birds E

Terrell County
Black-capped Vireo *Vireo atricapilla* Birds E
Bunched cory cactus Coryphantha ramillosa Flowering Plants T
Rio Grande silvery minnow *Hybognathus amarus* Fishes E
Texas hornshell (mussell) Popenaias popei Clams C

Terry County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Throckmorton County
Least tern *Sterna antillarum* Birds E
Piping Plover *Charadrius melodus* Birds E, T
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Tom Green County
Black-capped Vireo *Vireo atricapilla* Birds E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Least tern *Sterna antillarum* Birds E
Mountain plover *Charadrius montanus* Birds PT

Travis County
Austin blind Salamander *Eurycea waterlooensis* Amphibians C
Barton Springs salamander *Eurycea sosorum* Amphibians E
Bee Creek Cave harvestman *Texella reddelli* Arachnids E
Black-capped Vireo *Vireo atricapilla* Birds E
Bone Cave harvestman *Texella reyesi* Arachnids E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Jollyville Plateau Salamander *Eurycea tonkawae* Amphibians C
Kretschmarr Cave mold beetle *Texamaurops reddelli* Insects E
Mountain plover *Charadrius montanus* Birds PT
Tooth Cave ground beetle *Rhadine persephone* Insects E
Tooth Cave pseudoscorpion *Tartarocreagris texana* Arachnids E
Tooth Cave spider *Leptoneta myopica* Arachnids E
Warton's cave meshweaver *Cicurina wartoni* Arachnids C
Whooping crane *Grus americana*Birds E, EXPN

Trinity County
Neches River rose-mallow *Hibiscus dasycalyx* Flowering Plants C
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas prairie dawn-flower *Hymenoxys texana* Flowering Plants E

Tyler County
Louisiana pine snake *Pituophis ruthveni* Reptiles C
Red-cockaded woodpecker *Picoides borealis* Birds E
Texas trailing phlox *Phlox nivalis ssp. texensis* Flowering Plants E

Upton County
Black-capped Vireo *Vireo atricapilla* Birds E

Uvalde County
Black-capped Vireo *Vireo atricapilla* Birds E
Comal Springs dryopid beetle *Stygoparnus comalensis* Insects E
Comal Springs riffle beetle *Heterelmis comalensis* Insects E
Fountain darter *Etheostoma fonticola* Fishes E
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Peck's cave amphipod *Stygobromus* (=Stygonectes) *pecki* Crustaceans E
San Marcos salamander *Eurycea nana* Amphibians T
Texas blind salamander *Typhlomolge rathbuni* Amphibians E
Texas wild-rice *Zizania texan*a Flowering Plants E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Val Verde County
Black-capped Vireo *Vireo atricapilla* Birds E
Devils River minnow *Dionda diaboli* Fishes T Final P
Least tern *Sterna antillarum* Birds E
Mountain plover *Charadrius montanus* Birds PT
Texas hornshell (mussell) *Popenaias popei* Clams C
Texas snowbells *Styrax texanus* Flowering Plants E
Tobusch fishhook cactus *Ancistrocactus tobuschii* Flowering Plants E

Victoria County
Whooping crane *Grus americana*Birds E, EXPN

Walker County
Red-cockaded woodpecker *Picoides borealis* Birds E

Waller County
Mountain plover *Charadrius montanus* Birds PT
Whooping crane *Grus americana*Birds E, EXPN

Ward County
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Sand dune Lizard *Sceloporus arenicolus* Reptiles C

Washington County
Navasota ladies'-tresses *Spiranthes parksii* Flowering Plants E
Whooping crane *Grus americana*Birds E, EXPN

Webb County
Ashy dogweed *Thymophylla tephroleuca* Flowering Plants E
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Johnston's frankenia *Frankenia johnstonii* Flowering Plants AD, E
Least tern *Sterna antillarum* Birds E
Mountain plover *Charadrius montanus* Birds PT

Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Texas hornshell (mussell) *Popenaias popei* Clams C

Wharton County
Whooping crane *Grus americana*Birds E, EXPN

Wheeler County
Least tern *Sterna antillarum* Birds E
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Whooping crane *Grus americana*Birds E, EXPN

Wichita County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Wilbarger County
Least tern *Sterna antillarum* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Willacy County
Brown pelican *Pelecanus occidentalis* Birds DM
Green sea turtle *Chelonia mydas* Reptiles E, T
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Hawksbill sea turtle *Eretmochelys imbricata* Reptiles E
Kemp's ridley sea turtle *Lepidochelys kempii* Reptiles E
Leatherback sea turtle *Dermochelys coriacea* Reptiles E
Loggerhead sea turtle *Caretta caretta* Reptiles T
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Piping Plover *Charadrius melodus* Birds E, T
Texas ayenia *Ayenia limitaris* Flowering Plants E
West Indian Manatee *Trichechus manatus* Mammals E

Williamson County
Black-capped Vireo *Vireo atricapilla* Birds E
Bone Cave harvestman *Texella reyesi* Arachnids E
Coffin Cave mold beetle *Batrisodes texanus* Insects E
Georgetown Salamander *Eurycea naufragia* Amphibians C
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Jollyville Plateau Salamander *Eurycea tonkawae* Amphibians C
Mountain plover *Charadrius montanus* Birds PT
Tooth Cave ground beetle *Rhadine persephone* Insects E
Whooping crane *Grus americana*Birds E, EXPN

Wilson County
Whooping crane *Grus americana*Birds E, EXPN

Winkler County
Northern aplomado falcon Falco *femoralis septentrionalis* Birds E
Sand dune Lizard *Sceloporus arenicolus* Reptiles C

Wise County
Black-capped Vireo *Vireo atricapilla* Birds E
Whooping crane *Grus americana*Birds E, EXPN

Wood County
Least tern *Sterna antillarum* Birds E
Louisiana pine snake *Pituophis ruthveni* Reptiles C

Yoakum County
Lesser prairie-chicken *Tympanuchus pallidicinctus* Birds C
Sand dune Lizard *Sceloporus arenicolus* Reptiles C
Whooping crane *Grus americana*Birds E, EXPN

Young County
Golden-cheeked warbler (=wood) *Dendroica chrysoparia* Birds E
Sharpnose Shiner *Notropis oxyrhynchus* Fishes C
Smalleye Shiner *Notropis buccula* Fishes C
Whooping crane *Grus americana*Birds E, EXPN

Zapata County
Ashy dogweed *Thymophylla tephroleuca* Flowering Plants E
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Johnston's frankenia *Frankenia johnstonii* Flowering Plants AD, E
Least tern *Sterna antillarum* Birds E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E
Zapata bladderpod *Lesquerella thamnophila* Flowering Plants E

Zavala County
Gulf Coast jaguarundi *Herpailurus* (=Felis) *yagouaroundi cacomitli* Mammals E
Ocelot *Leopardus* (=Felis) *pardalis* Mammals E